FORESTRY ABSTRACTS

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AIR POLLUTION AND TREE GROWTH

By

G. SCURFIELD

PART II

(ii) *Fluorine*. F compounds have long been recognized [see, e.g. Reuss (1893)] as agents of pollution damage to vegetation. Recent reports [see, e.g., Bredemann (1956)] have tended to emphasize the injurious role of such compounds. F is present in rock phosphate, usually in amounts equal to or somewhat greater than that stoichiometrically required to form fluorapatite ($Ca_{10}F_2(PO_4)_6$) with the P content of the rocks. All commercial methods of processing rock phosphate to produce fertilizers, such as superphosphate, result in the volatilization of some F. The fact that, e.g. in the U.S.A., production of rock phosphate increased from some 5 million long tons in 1947 to over 12 million in 1952 [Anon. (1952)] emphasizes the increasing magnitude of the problem. Of other industries emitting F compounds into the air, the most important are steel and aluminium works. The former uses fluorspar and the latter cryolite, F compounds being released when these minerals decompose at high operating temperatures. Glass, enamel, brick, and ceramic works, and industries processing Pb, Sn, Cu and Ni, are also reported to be responsible for contaminating the air with F compounds. Weinhaus (1954–1955), for example, lists sources of F-containing gases in eastern Germany, viz. chemical works at Dohna producing wood preservatives from copper fluoride, tin-smelting works near Freiberg, glass works using copper fluoride and cryolite, superphosphate works, sometimes enamel factories, and occasionally brickworks if the raw material, as at Hartmannsdorf, contains F. It should be noted that, although the effects reported below are attributed to F-containing pollutants, there is uncertainty not only as to the form in which these exist in polluted air, but also as to the form in which they are first released to the air. All that can be said is that nearly all the F present in stack gas from $Ca_3(PO_4)_2$ furnaces, nodulizing kilns, and $Ca(PO_3)_2$ furnaces is in the form of HF, while much of that evolved from superphosphate manufacture is in the form of SiF_4, and that equilibria in the system SiO_2–SiF_4–HF–H_2O favour the formation of SiF_4 at low temperatures and HF at high temperatures [Hignett and Siegel (1949); Finger and Reed (1949)].

Adams *et al.* (1952) attributed to F compounds the damage to 50 sq. miles of *Pinus ponderosa* forest at Spokane, Washington, U.S.A., where trees over an area of 3 sq. miles were killed. This is the most important recent instance of extensive damage. Other cases reported include the following: to various fruit trees [Bredemann and Radeloff (1937); Radeloff (1939); Reckendorfer (1953)] and to Silver Fir and Norway Spruce [Huber (1956)] in Germany, to Scots Pine and Corsican Pine in the Netherlands [ten Houten (1957)], to *Acer pseudoplatanus* and *Crataegus monogyna* [Scurfield (1955)], to European Larch, Scots Pine, Norway Spruce, species of *Pterocarya*, *Corylopsis* and *Rhus* [Peace, reported by Metcalfe (1953)] and to Scots Pine [Peace (1952); Agate *et al.* (1949)] in Great Britain, to vines and to trees of Apricot, Chestnut, Apple, Pear and Cherry in the Rhone valley [Bovay (1954*a*, *b*)], and to various trees in Baden, Switzerland [Gisiger (1955)], to *Acer platanoides* [Romell (1941)] in Sweden, to Citrus trees in Florida [Wander and McBride (1956)] and California [Kaudy *et al.* (1955)], to Fig, Apricot, Plum, Lilac, blackberry and roses in California [De Ong (1946)], to trees of Italian Prune in Washington [Miller, Johnson and Allmendinger (1948); Miller *et al.* (1952)], to varieties of wine grapes in California [Brewer, McColloch and Sutherland (1957)]. Other examples are given by Bredemann (1956).

In the Spokane area, Shaw *et al.* (1951), from field observations, found the damage to the *Pinus ponderosa* forest to be zoned in its intensity about a centre coinciding with the industrial area north of the city. Chemical analyses of needles for F content indicated that this fell off with increasing distance from the pollution source, values decreasing from 620 p.p.m. at points 1 mile from the source to

25 p.p.m. 9 miles away. Analyses of the air and of rainfall pointed to a similar correlation between F content and distance from the source [Adams *et al.* (1952)]. Confirmation of the general conclusion that damage was due to atmospheric F compounds was obtained by transplanting gladiolus (a species known to be F-sensitive) and 5-year-old seedlings of *P. ponderosa* to three sites within the area of suspected F pollution [Adams *et al.* (1956); Adams, Shaw and Yerkes (1956)]. A linear relationship was found to exist between average atmospheric F content on these sites, and the damage caused to transplants. Damage to *P. ponderosa* was assessed quantitatively by calculating for each site 'injury indexes', i.e. damaged needle length × 100/total needle length. Injury similar to that observed on the field transplants, appeared when plants of gladiolus and seedlings of *P. ponderosa* were fumigated for 24 hours, under controlled conditions, with air containing 12 parts per 1000 million of HF [Shaw *et al.* (1951)]. Adams, Shaw and Yerkes (1956) carried out fumigation experiments with HF at 0·7,1·2 and 12·0 parts per 1000 million for 24, 48, 72, 96 and 120 hours, using seedlings of *P. ponderosa* aged about 5 years. They concluded that needles were many times more sensitive to damage when in the immature, partially elongated state, than when mature. The field observation that mature needles became increasingly resistant to damage as they became older was confirmed, even though the F content of such needles increased continuously up to the time of their abscission. Miller, Johnson and Allmendinger (1948), Griffin and Bayles (1952), Bovay (1954*a*, *b*), Gisiger (1955), Kaudy *et al.* (1955) and Wander and McBride (1956), also obtained indications of a relationship between the F content of leaves of various trees and the distance of the trees from the source of the F pollutant.

Brewer, McColloch and Sutherland (1957) have claimed that a direct relationship exists between the F content of leaves and the extent to which they show visible damage. Romell (1941) found 22 mg. F per kg. dry weight in visibly injured leaves, 16 mg. F in other parts of the same leaves, and 6 mg. F in healthy leaves of *Acer platanoides* 400 miles from an F source. According to Bredemann (1956), however, F content is not necessarily related to extent of visible injury. In Florida, Wander and McBride (1956) were unable to relate the degree of chlorosis of Citrus foliage to its F content, though the F contents (48–370 p.p.m. dry weight) of chlorotic leaves were greater than those (12–30 p.p.m.) of normal leaves. Indeed, Kaudy *et al.* (1955), in California, observed no injury on Citrus leaves containing up to 211 p.p.m. of F, a result attributed by Wander and McBride to differences in climate between that state and Florida.

Maximum F accumulation was said by Kaudy *et al.* to occur in Citrus leaves during summer and autumn. Griffin and Bayles (1952) reported values for the leaves of *Cornus florida* of 73 p.p.m. dry weight in May, 147 p.p.m. in June and 152 p.p.m. in October. Similar seasonal accumulations of F were found by Brewer, McColloch and Sutherland (1957), who recorded values for the leaves of grape varieties of 2–159 p.p.m. dry weight in June and 31–462 p.p.m. in September. Bovay (1954*b*) found leaves of Apricot, sampled after a season of dry weather, to contain higher amounts of F than those sampled after a wet season. These examples emphasize the need, as with SO_2 damage, to take into account differences in variables other than the amount of F passing to the air, when comparing the relative susceptibilities of species to damage on different sites. The many discrepancies that exist between lists of species arranged according to their degree of sensitivity to atmospheric F compounds, probably reflect something of the extent to which the sites examined have differed in factors such as soil and climate [cf., for example, the results of Wislicenus (1914), Haselhoff, Bredemann and Haselhoff (1932), Bredemann and Radeloff (1937), Bovay (1954*a*), Pelz (1956), and Bredemann (1956)]. There appears to be general agreement, however, that conifers and vines are relatively sensitive, and *Alnus* spp. relatively insensitive, to F compounds in the air. Among the commoner fruit trees, Apricot appears to be most, Pear and Apple least, easily damaged. Zimmermann and Hitchcock (1956) listed species according to the degree of leaf marking produced when they were fumigated with HF for several days, at concentrations ranging from 1·0 to 100 parts per 1000 million by volume. From comparison of the results obtained with those from SO_2 fumigation, these workers concluded that susceptibility to damage by SO_2 did not necessarily indicate susceptibility to damage by HF (see p. 347), a conclusion shared by Bredemann (1956) and Pelz (1956). Zimmermann and Hitchcock found no correlation between degree of susceptibility to either SO_2 or F damage and the number of stomata per unit leaf area of the various species, or between degree of susceptibility and the amount of Si, Ca, or Fe, present in the leaves. Zimmermann (1952) earlier reported that slight injury was caused to Prune leaves after 4 hours' fumigation with 0·07 p.p.m. of HF, and to Peach leaves after 6·7 hours with 0·085 p.p.m. Young plants of Pine, Peach, Apricot and Prune were consistently injured by 0·1 p.p.m. in experiments of less than 8 hours' duration. Injury was often followed by leaf abscission. Daines, Leone and Brennan (1952) applied comparable treatments (for an unstated time) to several plants, including *Pinus strobus* and Peach, and caused slight foliage injury. Griffin and Bayles (1952) found Peach, Apple, Norway Spruce and wild Black Cherry to be injured after a few hours of HF fumigation (concentrations from

0·05 to 0·77 p.p.m. in different experiments), Apple trees proving least sensitive. Differences in susceptibility to F damage are reported [Brewer, McColloch and Sutherland (1957)] for varieties of wine grapes. Walter (1956) found considerable variation among even-aged seedlings of *Pinus ponderosa* in their sensitivity to atmospheric fluorides. Similarly Pelz (1956) found differences in resistance to SO_2 damage among individual trees in a stand of Norway Spruce. Examples of this sort suggest the possibility of selecting or breeding plants tolerant of certain pollution conditions.

The fate of air-borne fluorides has been intensively studied by McIntyre *et al.* (1949) and McIntyre, Hardin and Hester (1952) on sites in Tennessee, U.S.A., subjected to F emissions from both aluminium and phosphate factories, and numerous other references are given by McIntyre in a recent summary (1957). The methods used included multiple monthly exposures of Spanish moss and limed paper as means of measuring progressive intake of F, determinations of F in rain and other waters, in soils and in minerals, in rainwater leachings from lysimeters, and in vegetation grown in the field, in greenhouses and in places where the air was free of F, as well as investigations into the effects produced on plants grown in soils to which various F-containing materials had been added. McIntyre concluded that: (i) increased F contents of foliage in polluted areas must be attributed almost entirely to uptake of air-borne F through the leaves; (ii) air-borne fluorides produce no measurable effects upon either the reaction or fertility of soils, or upon the uptake of F by plants from them. It may be noted that De Ong (1946) found amounts of between 247 and 403 p.p.m. of F in washings from the leaves of Fig and Apricot trees in an area of F pollution [see also Miller *et al.* (1952)], that Gaud, Charnot and Langlais (1934) in certain regions of Morocco found that most of the F carried by vegetation toxic to animals was accounted for by dusts of highly phosphatic soils, and that Shaw *et al.* (1951), Laurie, Hasek and La Fleur (1949), Johnson *et al.* (1950), Allmendinger, Miller and Johnson (1950), and Miller *et al.* (1952) used lime sprays to reduce damage to plants by air-borne fluorides. Using sand and water culture techniques, Leone *et al.* (1948) and Daines, Leone and Brennan (1952) found, e.g. that Peach seedlings in solutions containing 25 p.p.m. fluoride were slightly injured in 10–13 days, the plants absorbing up to 261 p.p.m. of fluoride. Under such conditions, plants accumulated greater amounts in the roots than in the leaves, the reverse of the condition holding when F was supplied as HF in fumigation experiments.

Though not new [see, e.g., Zimmermann (1952)], the method used by Wander and McBride (1956) to confirm the identity of suspected pollutants in the field merits mention. By spraying 4-year-old Citrus trees with $0{\cdot}1N$ solutions of either HF or H_2SiF_6, they were able to duplicate, on the leaves of such trees, symptoms identical with those observed in the field under conditions of suspected F pollution.

(iii) *Other specific pollutants.* Antipov (1956) lists 15 out of 20 perennials, planted in Leningrad, as damaged by HCl fumes periodically released from a chemical works near by. Schmidt (1951) attributed damage to several species of fruit tree in the Frankfurt-am-Main district to Cl gas. The possibility of damage to tree roots by illuminating gas leaking from underground mains (reported by Kny as early as 1871) has been examined recently by Gustafson (1950). Gustafson fed a continuous supply of 2–4% natural gas to the roots of American Elms throughout the growing season for 5 successive years and, though the roots suffered slight injury, no significant effect was produced on the growth of the trees. Zimmermann (1952) illustrated the damage to roses and other woody perennials collected near a factory manufacturing preparations of 2,4-D, and mentions two sites where Cl gas damaged plants, including trees. Daines (1952) also reports cases of injury to trees and other plants near works manufacturing 2,4-D. Severe injury to plants, including Rhododendron, Apple and Apricot, by waterglass (Na or K silicate) dusts from a detergent factory was recorded by Czaja (1951) and attributed largely to the high alkalinity of such dusts. Dusts from factories using alkaline salts were reported by Wienhaus (1954–1955) to cause damage to vegetation in Thuringia. Anagnostopoulos (1950) attributed the unfruitfulness of Olive trees at Eleusis, in Greece, to dust emitted from a cement works near by. Mazzolani (1953) described a similar case in Italy. There is thus a need not only to consider the possibility of damage by chemically inert dusts, as distinct from gases, but also to member that some dusts are chemically active. Generally, however, the damage from specific pollutants, other than SO_2 and F compounds, may be regarded as relatively unimportant, the more so when the more universal effects of general air pollution are considered.

4. DIAGNOSIS OF POLLUTION DAMAGE

For many species, symptoms of damage have been adequately described and illustrated in many publications dealing with pollution damage to plants in the field and in fumigation experiments [see, e.g. Katz *et al.* (1939); Thomas (1951); McCabe (1952); Bredemann (1956); Thomas (1956*b*); Middleton *et al.* (1956)]. It is well, however, to emphasize the difficulty of distinguishing, in the field, between injury from air pollutants and that from some other cause, notably so-called ‘winter injury’.

There is also the possibility of damage being caused by pollution and, say, frost, acting together [see, e.g., Wentzel (1956*a*)]. Massay (1952) and Weatherall [reported by Grayson (1956)] recently commented on the former point. Massay suggested that adequate diagnosis of injury by pollutants in the field could only be assessed by a team experienced in plant diseases, insect pests, cultural practices and varietal responses. Scheffer and Hedgcock (1955) apparently disagree with this opinion since they list a number of characteristics of damage to conifers which served them as a means for distinguishing SO_2 injury from drought and winter injury. For example, trees killed by SO_2 tended to die gradually and to have a deficiency of needles at death; trees killed by winter or drought injury died rapidly but had a full complement of needles at death.

Numerous methods have from time to time been proposed for the diagnosis of pollution damage, especially beyond the area where plants show visible leaf injury. In addition to chemical analysis of leaves, such methods include discoloration of lenticels [Neger (1919)], the formation of phaeophytin in leaves injured by SO_2 [Dorries (1932)], the insolation test of Hartig [reported by Jahnel (1954–1955)] (cut branches of sound and injured Spruce compared for rate of water loss in sunlight), the opacity test of Härtel (1953) (needles of Spruce boiled with water and the opacity of the resulting wax emulsion determined photometrically), the hygroscopicity test of Härtel (1954) (the hygroscopicity of the dried plant material being determined and compared with values for cuticular transpiration), the degree of coating of leaves by dust and soot, and microscopical examination of leaf anatomy [Grüll (1955)], measurements of photosynthesis and transpiration rates [Keller (1958)] and the fluorescence under ultra-violet light of smog-marked leaves [Nielsen, Benedict and Holloman (1954)]. Pelz (1958*a*) concluded from data obtained from the Härtel opacity test that large numbers of determinations were necessary before trends in the relationship between opacity and pollution damage could be discerned. Jones (1952) presented data which suggested the possibility of using the species composition of the lichen flora of tree boles, especially of Elm and Ash, as a means of comparing the degree of smoke pollution of the atmosphere at different places.

Generally speaking, however, no single method would appear to be absolutely reliable when dealing with SO_2 and smoke damage [Härtel (1954); Jahnel (1954–1955), commenting on Dorries' and other methods].

5. PHYSIOLOGICAL ASPECTS OF AIR POLLUTION

Under this heading may be considered: (*a*) the influence of environmental factors, such as temperature, humidity, light intensity and day length, on the relative susceptibility of various species to pollution damage; (*b*) the mode of entry of pollutants into the plant and their subsequent translocation therein; and (*c*) the physiological responses of the plant to pollutants, and the biochemical processes underlying such responses. There is a notable lack of information on these points for woody perennials, but the results obtained with other species merit consideration. Taking each aspect in turn:

(*a*) *Influence of the environment.* The general conclusion of Katz *et al.* (1939) was that environmental factors producing high leaf turgor, fully open stomata and maximum photosynthesis were those rendering plant more susceptible to injury by SO_2. Dormant plants, those kept in darkness, and those growing on soils with moisture contents near the wilting point showed reduced susceptibility to damage. Keller (1958), too, reporting on experiments carried out by himself and Koch on the effects of SO_2 fumigation on the respiration, photosynthesis and transpiration of conifers (see below), found sensitivity to damage to be greatest under conditions of fine weather and, therefore, of most active photosynthesis. Similarly, in experiments with tomato, Daines, Leone and Brennan (1952) found that plants growing under optimum conditions with respect to N, Ca and P tended to be more susceptible to injury by F than nutrient-deficient plants; high atmospheric humidity, turgidity of the plants and wetting of plant surfaces were also inclined to increase the extent of injury. Koritz and Went (1953) arrived at much the same conclusions from their experiments on the effects of smog upon the growth of tomato plants; growth was depressed when the smog was applied in the light at midday, or in the early afternoon, but smog had no effect when applied in darkness or in light after a period of darkness. These results were interpreted in terms of stomatal movement and photosynthesis; plants photosynthesizing at a slow rate were less susceptible to smog damage. Injury was also more severe when the plants were highly turgid. Kendrick, Middleton and Darley (1953) reported that spinach plants grown for 10 weeks at a mean air temperature of 13° C. and then at 24° for 1 week before smog fumigation were damaged much more severely than those grown continuously at 13°. Plants with abundant N supply were more severely injured than N-deficient plants. Lettuce grown for 10 weeks at 24° and then at 13° for 1 week before fumigation showed only a trace of injury; plants kept at 24° continuously had 80% of their leaf area damaged. It was concluded that minimum concentrations of pollutants necessary to produce damage must be considered in relation to the pre-fumigation environment of the plant. Juhren, Noble and Went (1957), in order to standardize the conditions under which *Poa annua* might be used as an indicator of smog concentrations, defined in some detail the temperature, photoperiod and light-intensity conditions under which sensitivity of the grass to damage was greatest. Their statement that plants grown under high-temperature conditions gained sensitivity when transferred to cool conditions, while those grown in cool conditions lost sensitivity when changed to high temperatures, is to be compared with that of Kendrick *et al.* cited above. Smog sensitivity was not correlated with either the growth rate or size of the plants, but was to a high degree related to the area over which stomata were wholly or partly open.

Despite the conclusion that environmental factors conducive to high physiological activity are those under which damage by air pollutants is likely to be greatest, there are also claims that unfavourable growing conditions might increase susceptibility to damage. Thus Pelz (1958*b*) regarded nutrient-deficient soils as increasing the susceptibility of Scots Pine growing on them. Indeed, it is upon such claims that attempts to improve the resistance of trees to damage by improving soil conditions have been based. Němec (1957), for example, claimed to have increased the resistance of a number of deciduous tree species to smoke by mulching with heather or addition of ground basalt. Bobko and Fortunatov (1958) used ammonia solutions, either alone or with urea, as fertilizer sprays with a similar end in view.

(*b*) *Mode of entry and translocation of pollutants.* Entry of SO_2, of smog oxidants, and possibly of other pollutants, is believed to take place largely through the leaf stomata. Intercellular spaces within the mesophyll (at least in dorsiventral leaves) no doubt provide chambers where a pollutant might accumulate in contact with wet cell-walls at or in which it might react. It remains uncertain whether damage to palisade parenchyma in dorsiventral leaves is an internal consequence of spongy mesophyll damage, or whether it follows penetration of the upper epidermis by the pollutant.

There are difficulties, however, in the way of the simple hypothesis above, viz. that pollutants enter the plant solely through leaf stomata. Recent evidence in its favour comes from Hendrix and Hall (1957) who, after examining 42 varieties of gladiolus, concluded that low stomatal frequency and/or small stomatal-well size were associated with resistance, whereas more susceptible varieties tended to possess higher stomatal frequencies and/or greater well size. On the other hand, in their investigation of the relative susceptibility of both woody and non-woody perennial species to SO_2 and F damage, Zimmermann and Hitchcock (1956) found no correlation between susceptibility and number of leaf stomata per unit area in any species. Nor was a greater number of stomata found in damaged areas of leaves that showed the localized, spotting type of injury caused, for example, by F [Solberg and Adams (1956)].

Bredemann and Radeloff (1937) found that forest and fruit trees exposed in summer or winter to F pollution could accumulate large amounts of F in the bark and, more rarely, the wood. Unless damage had been very severe, flushing and shoot development in a F-free atmosphere in the following spring were little or not affected, and the new shoots contained no F. [See also Bredemann (1956.)]

Translocation of pollutants and/or the products of their action within the plant, would appear to merit further investigation. From the indirect evidence that reduction in yield of alfalfa and other crops due to destruction by SO_2 could be closely duplicated by clipping off an area of leaf equal to that destroyed, from unfumigated plants, Hill and Thomas (1933) concluded that SO_2 was not a systemic poison: its damaging effects were confined to the local sites of injury. Protracted fumigations with sub-lethal concentrations of SO_2, however, increased the yield of S-deficient alfalfa plants [Thomas *et al.* (1943)]. Moreover, in fumigation experiments with $S^{35}O_2$, the fate of the pollutant (when it did not cause permanent injury) after entry into the plant was shown to be hardly distinguishable from that of $Na_2S^{35}O_4$ after entry through the roots. Such results indicate translocation of the reaction products of SO_2 in the absence of visible injury; visible leaf injury supervened when the rate of uptake exceeded the capacity of the plant to metabolize the pollutant, or to translocate it, or its reaction products [Zimmerman and Hitchcock (1946)].

In the case of F, Daines, Leone and Brennan (1952) found plants to be capable of accumulating large amounts of fluoride both from the atmosphere and from soil. The problem of distinguishing between F coming from the atmosphere and from the substrata was partly solved by analyses of leaves and roots. The distribution gradient of F in the plant was characteristic of the source of entry. Atmospheric F resulted in a high leaf and low root content of F; uptake of fluoride from soils gave a high content in leaves and an even higher content in roots. Leone, Brennan and Daines (1956) also confirmed the finding of Zimmermann and Hitchcock (1946), that a certain amount of absorbed gaseous F was dissipated from foliage (of herbaceous species) during a short period after fumigation with F.

Anatomical investigations on *Pinus ponderosa* [Solberg, Adams and Ferchau (1955)], and Apple

Apricot and Prune leaves [Treshow (1956); Solberg and Adams (1956)] showed that changes due to fluorides were limited to the area within 1 or 2 mm. of the visibly injured, necrotic tissue. Solberg and Adams (1956) believed the differential responses of various areas of the same leaf, especially of tips and margins, to result from high accumulation of the pollutant in such areas after the entry of sub-phytotoxic concentrations more or less uniformly over the leaf-blade. Absorption of F over the whole leaf surface followed by acropetal translocation through the vascular system to leaf margins and tips was also held by Thomas (1951) to account for the appearance of injury in these areas first. Romell (1941), however, using leaf models cut from indicator papers, explained the border effects seen in leaves injured by smoke containing HCl, HNO_3 or F, as due to an uneven uptake of gas resulting from the distortion of diffusion fields in the air round the edges and protruding extremities of leaves. The possibility of differential sensitivity of those leaf portions that show injury first, should not be overlooked.

(*c*) *The physiological responses of plants to pollutants.* It is necessary to emphasize that with pollutants such as SO_2, F, O_3 and smog oxidants, we are dealing with entities that are extremely reactive chemically. That such pollutants exert specific effects within plants is therefore very unlikely, except perhaps at very low concentrations. In view of this, the question arises as to how far such effects are capable of analysis in physiological and biochemical terms, and how far such analysis is likely to contribute to our understanding of plant processes in general or to the solution of practical problems of pollution damage. That some contribution in the latter sense is possible was shown recently. Freebairn (1957), after demonstrating that ascorbic acid could reverse the inhibitory effect of O_3 on the oxygen uptake of mitochondria, experimented successfully with K-ascorbate preparations as spray treatments to protect plant foliage against smog (oxidant) damage [Freebairn (1958)]. Previous attempts to use spray treatments for this purpose involved the use of sucrose [Koritz and Went (1953)] and various commercial preparations [Kendrick, Middleton and Darley (1954)].

As regards the analysis of pollution effects in physiological terms, investigations have not gone much beyond the determination of such effects upon over-all physiological processes such as photosynthesis, respiration and transpiration. Katz *et al.* (1939) demonstrated that SO_2 fumigation inhibited photosynthesis in alfalfa. In the absence of visible leaf damage, this effect was perceptible when SO_2 concentrations were around 0·40–0·50 p.p.m. Fumigations of several hours each day with concentrations of SO_2 of 0·25–0·35 p.p.m. in direct sunlight had no measurable effect on photosynthesis; with high SO_2 concentrations, the rate of photosynthesis was rapidly reduced to a level consistent with the proportion of the total leaf area showing damage. The effects of fumigation on respiration were less clear; generally an increase in respiration was recorded. Keller (1958) fumigated conifers with SO_2 (4–6 mg./cu.m. air) in experiments of short duration under variable weather conditions. A decline in rate of photosynthesis following SO_2 treatment was recorded in all cases, its extent depending on species and weather. Rate of respiration was stimulated. Keller, on the basis of these results, suggested the use of measurements of photosynthesis as a means for detecting early pollution injury.

Recent experiments to determine the effects of atmospheric fluorides upon plant respiration include those of McNulty and Newman (1956, 1957) and Hill *et al.* (1958, 1959). McNulty and Newman (1956) attributed reductions in the respiration rate of Peach and Prune foliage to fluorides in the atmosphere. They have since (1957) reported obtaining increases in the respiration of gladioli and beans at fluoride levels sufficient to produce visible leaf damage. Hill *et al.* (1958), using tomato as test plant, recently reported results of an investigation into the possibility of 'invisible injury' caused by fluoride pollution. No differences could be detected in growth, photosynthetic rate, respiration rate or chlorophyll content between control plants and plants fumigated with concentrations of HF greatly in excess of those likely to be emitted by industrial works. Italian Prune and Apricot were among the species used in a subsequent investigation in which no direct effect of F (1·10 and 3·00 μg./cu.m. in different experiments) on respiration was detectable unless visible leaf injury developed [Hill *et al.* (1959)].

The effects of smog (usually in the artificial form of O_3 + 1-hexene) on photosynthesis and respiration of *Lemna minor* have been investigated by Erickson and Wedding (1956), on the respiration of lemon fruit by Todd (1956*b*) and on the photosynthesis and respiration of beans and Valencia orange cuttings by Todd (1958*b*). Erickson and Wedding found photosynthesis of *Lemna minor* to be reduced after exposure to O_3 alone and even more so after exposure to O_3 + hexene. Respiration was stimulated by the mixture, but not by O_3 alone. Hexene by itself had no effect on either respiration or photosynthesis. Todd (1956*b*) makes the point that the increased respiration of lemon fruit exposed either to O_3 alone or to O_3 + hexene was not accompanied by visible injury to the fruit. He has since reported (1958*b*) that no stimulation of respiration or inhibition of photosynthesis occurred in beans exposed either to O_3 or O_3 + hexene unless visible injury developed; Citrus leaves behaved similarly with O_3. With Valencia orange leaves, however, O_3 caused a rise in respiration rate when no symptoms of damage were visible. Interspecific differences of this sort again warn against the acceptance of any general statement about the relation between deleterious physiological and biochemical effects of pollutants and the development of visible symptoms of damage. There is a need to explain the decreases in plant growth caused by exposure to O_3 + hexene [Koritz and Went (1953); Todd (1956*a*); Taylor (1958); Taylor *et al.* (1958)] by processes other than inhibition of photosynthesis or tissue injury [Todd (1958*b*)].

Koritz and Went (1953) included a study of smog effects upon transpiration and water-uptake rates in their investigation; both rates were diminished in tomato. Keller (1958) found that similar reduction in transpiration followed, after some days, the exposure of 2-year-old clonal grafts of Silver Fir, Spruce and Scots Pine to SO_2.

There is little information regarding the biochemical background of the observed physiological responses of plants to pollutants. Chemical analyses have progressed somewhat beyond the determination of S and F in affected plants. According to Katz (1949—summarizing earlier work), fumigation of barley or alfalfa with SO_2 had no effect on moisture, protein, or total sugars + starch contents of leaves unless the leaves were severely damaged, when moisture, sucrose, starch and alcohol-soluble N contents decreased and ,insoluble N content increased. From their experiments using S^{35} as tracer, Thomas *et al.* (1944) and Thomas, Hendricks and Hill (1944) concluded that the S^{35} was changed to sulphate and organic forms such as cystine and methionine. In more recent work, reduction in chlorophyll content of leaves after fluoride fumigation was noted by Newman and McNulty (1957), but not by Hill *et al.* (1958); a reduction following smog treatment was reported by Erickson and Wedding (1956). Mader, Cann and Palmer (1955) found an increased amount of formic acid and acetic acid in spinach leaves after treatment with smog. Todd (1958*a*) has found wide variations in the sensitivity of the enzymes catalase, peroxidase, papain and urease to O_3 *in vitro*. Wedding and Erickson (1955) have recorded a decrease in the permeability of the cells of bean leaves to $P^{32}O_4$ upon exposure of the plants to O_3 + hexene, though an increase could be obtained when exposure times were lengthened.

6. METEOROLOGICAL ASPECTS OF AIR POLLUTION

The effects of meteorological conditions are important in any consideration of the facts influencing the concentration of pollutants in the air and the dispersal and removal of such pollutants, and as regards the location of forestry and parks projects in relation to pollution sources and the establishment and planning of new industrial sites and urban areas.

Seasonal trends in the concentration of certain pollutants (usually SO_2 and smoke) and their spatial distribution over large centres of population have been reported, e.g. for Leicester [Anon. (1945)] and for Manchester [Scurfield (1955)] in England, for New York [Greenburg and Jacobs (1956)] and other cities in the U.S.A. [Meller, Alley and Sherrick (1938)] and for the Detroit-Windsor area, Canada [Katz (1952)]. For Leicester, the seasonal trend for oxides of S and smoke, and for sulphates, total dissolved matter and insoluble matter in rainwater collected in rain gauges, showed curves of the same form, i.e. sine-shaped, with the maximum concentrations occurring about midwinter and the minimum about midsummer. Evidently, in such conditions, deciduous trees and shrubs which break dormancy in late spring and drop their leaves in early or mid-autumn escape the most damaging phases of pollution intensity. Evergreens, such as conifers, on the other hand, are exposed to more than one pollution cycle, and the effects may be cumulative.

Underlying such seasonal trends there are weekly and diurnal trends that are related not only to time trends in fuel consumption, but also to meteorological conditions such as strength and direction of winds, turbulence, and the frequency of temperature inversions.

Meteorological conditions influencing the dispersal and removal of air pollutants have been examined and discussed by Dean and Swain (1944) at Trail, British Columbia, by workers [Anon. (1945)] at Leicester, England, by Magill (1949) and Neiberger (1957) at Los Angeles, by Absalom (1954), Wilkins (1954) and others for London during the 1952 smog 'incident' there and, generally, by Dobson (1948) and Gosline *et al.* (1956). The frequency and duration of periods of temperature inversion are of particular interest. Absalom (1954) gives an excellent account of the manner in which such inversions can arise. Valley sites like those in the S. Pennines of Great Britain, for example, are probably subject to frequent temperature inversions; the Los Angeles Basin also is a site well known for such inversions. These inversions, in the absence of suitable winds, lead to the stagnation over the site of a layer of warm air that effectively prevents air contaminants from escaping. If, at the same time, the site is subjected to continued pollution from industries and towns occupying the valleys, concentrations of contaminants may be built up that can cause damage, sometimes within a few hours. The occurrence of such inversions in the valley of the Meuse in 1930, at Donora, Pennsylvania, in 1948, at Poza Rica, Mexico, in 1950, and over London in 1952, led to concentrations of pollutants that proved lethal, directly or indirectly, to human beings. The London smog period in 1952 caused a 50% increase in the average monthly SO_2 readings for the area [Wilkins (1954)].

The results of Dean and Swain (1944) at Trail indicate the importance of the duration and frequency of such inversions as regards forest and other damage. Okanoue (1958) describes a more recent instance of damage (to 1- to 5-year-old stands of *Pinus densiflora*) after the accidental release of high concentrations of gases from a smelter 1–3 km. distant during a period of temperature inversion. There would appear to be a need to reduce the maximum permissible concentrations of pollutants allowed to pass into the air and to restrict or halt industrial operations, especially those such as soot-blowing, during periods of temperature inversion deemed likely to persist for some time. Ideally, rates of emission should be regulated in accordance with the diffusing properties of the atmosphere at any time. This suggests the possibility of meteorological control of industrial operations; such control, however, is both impracticable and uneconomic in most cases (especially for industries, such as aluminium works, where operations are continuous) even if the dispersion forecasts could be made anything like infallible. Nevertheless, success has been achieved in isolated cases, as witness the meteorological control of SO_2 emission at Trail [Dean and Swain (1944)]. Generally, however, it can be said that when siting large-scale forestry projects in areas where pollution is likely to be a factor of some importance to tree growth, a thorough evaluation of the local meteorological characteristics over a reasonable period would be worth considering. Industries already located in the vicinity of such projects would be well advised in their own interest to undertake a similar evaluation for their sites.

The possible ways of eliminating smog by weather modification have been assessed by Neiberger (1957). The general conclusion was that such methods would be even more difficult or costly than control of the pollution sources.

For further information on meteorological aspects of air pollution, see Gosline *et al.* (1956).

7. MITIGATION AND PREVENTION

To set pollution problems in their correct perspective, they must be viewed against a background of industrial competition both within and between various countries. With regard to the former, restrictive legislation imposing conditions under which pollutants might be emitted to the air by industrial undertakings has nearly always been found necessary in order to reconcile private with public interest [see Davenport and Morgis (1954) for numerous references]. Legislators need to be fully aware of the considerations, especially those of engineering, that limit compliance, so that standards will not be set that are impossible for industries reasonably to attain, bearing in mind their efficiency and national importance. Meetham (1956) and Johnstone *et al.* (1956), for example, have dealt fully with the means available for reducing or preventing the emission of smoke, ash, grit and SO_2, both before and during the burning of coals and petroleum products. In nearly all cases, domestic or industrial, the ultimate limiting factor is economic, though much has been done, and still can be done, by improvement of the design of fuel-burning appliances, by the installation of efficient dust arrestors, electrostatic and other precipitators, the electrification of railways, structural alterations to chimney-stacks and cooling towers, the prevention of mine tips from burning, the reduction of hydrocarbon emission by engine exhausts, etc. From a national point of view, however, it is now necessary to reconsider the economics of the situation in view of the generation of electricity by nuclear power stations of the Calder Hall (Great Britain) type. Within the foreseeable future, assuming that power will be derived increasingly from this source, air pollutants will tend to become those specific to such stations or to the type of raw material being processed by particular industries. Marley (1956) has analysed the problems of control of radiological hazards in the future development of atomic energy. There is an obvious need for intensive study of the means whereby pollutants of this type may either be prevented from reaching the air or reach it in a form and concentration innocuous from biological and other points of view. In this connexion, attention may be drawn to the recent study by Middleton (1959) on the extent to which fission products (Cs^{137} and Sr^{89}) deposited on growing crops can contaminate the edible tissues and on the possible lodging, on vegetation, of some 25% of the fall-out from the explosion of a single nuclear weapon [Russell and Possingham (1959)].

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CORRIGENDUM

F.A. 21 (3): p. 346, line 6,
for Wislicenus (1901, 1918)
read Wislicenus (1901, 1914*a*).

(*The previous part of the above article appeared in* F.A. 21 (3). *Reprints of the whole article are available from* Central Sales Branch, Commonwealth Agricultural Bureaux, Farnham Royal, Bucks., England, at 4*s.* 6*d.* each, post free.)

ABSTRACT SECTION

0. FORESTS, FORESTRY, AND THE UTILIZATION OF FOREST PRODUCTS: GENERAL

For general *regional* accounts see section 90

Translations

See Nos. 4062, 4730 4877, 4889, 4947, 5037.

0 (038). Dictionaries. Encyclopaedias

See No. 4176.

0 (048.1). Bibliographical Lists

See Nos. 4046, 4101, 4109, 4176, 4402, 4410, 4505, 4508, 4516, 4531, 4604, 4691.

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3930. Ribeiro, F. Lopes [Editor]. *Estudos e Informação*—índices classificados dos 100 trabalhos publicados de julho de 1953 a dezembro de 1958. **[*Estudos e Informação*—classified indexes to the 100 issues published from July 1953 to December 1958.]** *Estud. Inform. Serv. Flor. Aqüic. Portugal* No. 119-G7, 1960. pp. 45. [Port.] Limited distribution.

The series is listed (1) by authors, (2) by subject, and (3) in chronological order.

3931. ***Soobščenija Laboratorii Lesovedenija.*** Izdatel′stvo Akademii Nauk SSSR. Moscow.

Replaces *Soobšč. Inst. Les.* Citation in *F.A.*: *Soobšč. Lab. Lesoved., Moskva.*

3932. ***Scientific Reports of the Saikyo University, Kyoto (Agriculture).*** Faculty of Agriculture, Kyoto Prefectural University, Kyoto.

From 1.5.59 (No. 11, 1959) the title of this series has been changed to *Scientific Reports of the Kyoto Prefectural University (Agriculture)*. Citation in *F.A.*: *Sci. Rep. Kyoto Prefect. Univ. (Agric.).*

0 (084.3/4). Maps. Atlases

3933. Weltforstatlas. **[World forestry atlas [part].]** Fritz Haller Verlag, Berlin. 1959.

[Cf. *F.A.* 20 No. 2689.] Further sheets, as follows: Southeastern Europe—Greece (species distribution, woodworking industries, forest % and ownership, growing stock, afforestation, resin and wood production, timber trade, etc.); Albania, Bulgaria, Rumania (woodworking industries, vegetation types, forest distribution and area %, wood production, timber trade). Western Asia—Iran, Iraq (forest distribution, distribution of the most important species); Cyprus, Israel, Jordan, Lebanon, Syria (forest distribution, afforestation, distribution of precipitation, timber trade). United States of America (forest types, forest distribution and ownership, growing stock and annual increment; distribution of the most important species).

3934. Janssen, P. L., and Weiland, M. R. **Softwood distribution maps for the South.** *For. Surv. Release Sth. For. Exp. Sta.* No. 83, 1960. pp. iv + 12 maps.

The maps present the relative concentration and approximate range in 12 Southern states, of 11 species (*Pinus palustris*, *P. elliottii*, *P. taeda*, *P. echinata*, *P. serotina*, *P. virginiana*, *P. clausa*, *P. strobus*, *Taxodium distichum*, *Tsuga* spp. and *Juniperus* spp.).

3935. **[Map of] land use, Sierra Leone. Sheet D. Rhombe.** Directorate of Overseas Surveys, Tolworth. 1959. 1 sheet. Scale 1 : 16,000 (approx.). Price 3*s.* 6*d.*

Obtainable from Edward Stanford Ltd., London, and Surveys and Lands Department, Sierra Leone.

0 - - 011. Terminology. Nomenclature

See No. 3944.

0 - - 015. Mathematical and Statistical Methods

3936. Freese, F. **Testing accuracy.** *For. Sci.* 6 (2), 1960 (139–45).

Discusses the basic requirements of a test for checking the accuracy of a new estimating or measuring technique against an accepted standard, showing how the chi-test meets these requirements and pointing out why the *t*-test may be misleading when so used.

1. FACTORS OF THE ENVIRONMENT. BIOLOGY

11. Site Factors: Climate, Situation, Soil, Hydrology (Water Conservation, Soil Conservation and Erosion)

111. The Atmosphere. Meteorology. Climate and Microclimate

111.1. Composition, Structure, Mechanics and Thermodynamics of the Atmosphere in General

3937. Miller, R., and Rüsch, J. Zur Frage der Kohlensäureversorgung des Waldes. **[The CO_2 supply of the forest.]** *Forstwiss. Cbl.* 79 (1/2), 1960 (42–62). 26 refs. [G.g.]

Investigations were made in Sept. and Oct. 1953 in an old Spruce/Silver-Fir stand [cf. *F.A.* 21 No. 1426], and in June and July 1958 in a Beech/Spruce/Larch stand. It was found that during the night the air in and above a stand contained a relatively high % of CO_2, but soil and crown respiration cause the CO_2 content to decrease hyperbolically with increasing height from the ground. Because of the reduced exchange and leaf respiration, a certain rise in the total CO_2 level takes place within the stand during the night. During the day the absolute CO_2 content in and above the stand is reduced (because of CO_2 consumed in assimilation) by ca. $\frac{1}{20}$ to $\frac{1}{5}$ of the basic content, the zone of lowest

CO_2 content being in the upper crown. There is a CO_2 surplus in the lower part of the stand throughout the day and a CO_2 deficit above. Strong wind smooths out both vertical and temporal differences in CO_2 content, and is effective even in the middle of the stand down to near ground-level. Small differences in protection from wind in the stand therefore cause measurable (though trifling) horizontal differences in CO_2 content even within a small area. The supply of CO_2 in a stand in the morning, and the soil respiration during the day, meet only a small part of the CO_2 assimilation requirement. Most of the CO_2 is taken from air above the stand, this source being replenished by soil and crown respiration at night. An appendix discusses the new radioactive carbon (C^{14}) method of tackling such investigations.

111.2. Radiation and Temperature

See also Nos. 4137–8, 4221.

3938. HERBST, W. Baum und Wald gegen radioaktive atmosphärische Beimengungen. **[Trees and forests as protection against radioactive pollution of the atmosphere.]** *Allg. Forstzeitschr.* 15 (13), 1960 (194–5). [G.]

Discusses results of measurements in various parts of Germany, partly on fall-out models, partly under natural conditions. Deposition of radioactive material on vertical surfaces was considerable. On horizontal surfaces in the centre of towns it was markedly greater than in the suburbs. In the Black Forest, radioactivity of foliage of isolated Beeches on the surfaces exposed to the weather was 2–4 times that on the sheltered side, that of grass on a W. slope ca. 3 times that on the E. slope, and of grass on open slopes 5 times that of grass on the lee side of a forest. In a series of measurements taken after the passing of a radioactive cloud in Nov. 1958, radioactivity of vegetation on W. or N. exposures averaged 32 times that of areas sheltered by forests or trees.

3939. ROUSSEL, L. Méthodes britanniques récentes pour mesurer la lumière en forêt. **[Recent British methods for measuring light in the forest.]** *Rev. for. franç.* 12 (3), 1960 (198–200). [F.]

Reviews a number of articles [cf. *F.A.* 18 No. 1224; 19 No. 3741; 20 Nos. 6, 2963].

3940. EVANS, G. C., WHITMORE, T. C., and WONG, Y. K. **The distribution of light reaching the ground vegetation in a tropical rain forest.** *J. Ecol.* 48 (1), 1960 (193–204). 6 refs.

A survey of illumination in tropical rain forest in Singapore provides data on the occurrence of sunflecks, and also on illumination in the shade with the sun (*a*) shining, and (*b*) obscured by cloud. These data are used to investigate the pattern of light on sample plots on the forest floor under cloudy conditions, and it is shown that this pattern does not vary appreciably from day to day. The daily march of light intensity under cloudy conditions is shown to be affected by two factors, a steadily increasing maximal intensity as noon approaches and, concurrently, an increasing number of periods of very low intensity due to the accumulation of dense cloud near midday on the days of observations. The pattern on the forest floor under sunny conditions, without sunflecks, is compared with that under cloudy conditions and is shown to be substantially different. The problem of readings taken under hazy conditions (when thin wispy clouds partly obscure the sun) is considered, and these are shown to approximate very closely on average to those made when the sun was shining but there were no sunflecks. The distribution of light reaching the forest floor between the three categories of cloudy, hazy and sunny conditions excluding sunflecks, and in the sunflecks themselves, was followed for 4 hours in the middle of the day and showed the large contribution made by the sunflecks, together with the large drop in intensity during the cloudy and rainy period about noon. The conversion of the arbitrary units used into absolute units is discussed, and it is shown that, during these four midday hours, about 130 cal. of light per sq. dm. reached the ground vegetation in the form of sunflecks, shaded conditions totalling less than 160 cal. per sq. dm. Finally, a comparison is made between lighting conditions on two separate sample plots, showing that, in the absence of sunflecks, substantially more light reached the ground vegetation on one plot than on the other, whether under cloudy or sunny conditions, while the bulk of the sunflecks contributed roughly equal quantities of light to the two plots, there being insufficient evidence to generalize about the incidence of very bright sunflecks, which were of rare occurrence. [Cf. *F.A.* 20 Nos. 4047–8.] *From authors' summary.*

111.7. Humidity, Evaporation. Clouds etc. Precipitation

3941. LAW, F. **Contribution to the hydrological symposium on water and woodlands Hanoversch-Münden, West Germany, September 1959, augmenting the paper by A. Bleasdale.** International Association of Scientific Hydrology [Hanoversch-Münden, W. Germany]. [1959.] pp. 2 + 1 gph. + 3 tbls. [E.] Limited distribution.

[Cf. *F.A.* 21 No. 1353.] Experiments with rain gauges at various heights from the ground showed that catches were 4–13% less than in standard ground-level gauges. Fitting cone-shaped shields improved the catch up to 3 ft. from the ground, but not higher. For measuring precipitation over forests, gauges on poles, about 10 ft. above the canopy, are recommended; for these, 15% should be added to the recorded catch.

111.8. Climatology. Climate and Microclimate

See also Nos. 4192–4, 4219, 4221, 4226, 4253, 4259–60, 4407–8, 4592, 4756, 4766, 4779.

3942. RODE, A. A. Klimatičeskie uslovija rajona Džanybekskogo stacionara. **[Climatic conditions in the region of the Dzhanybek Experimental Station.]** *Soobšč. Lab. Lesoved., Moskva* No. 1, 1959 (4–40). 7 refs. [Russ.]

Presents tabulated long-term data on air temperature, soil freezing, precipitation, r.h., evaporation, dry winds, wind, snow cover, and surface run-off of snow melt, and surveys the meteorological conditions in the period 1950–55.

3943. Waggoner, P. E., Pack, A. B., and Reifsnyder, W. E. **The climate of shade. A tobacco tent and a forest stand compared to open fields.** *Bull. Conn. Agric. Exp. Sta.* No. 625, 1959. pp. 39. 20 refs.

The study reported here was mainly directed towards tobacco culture, but conditions within a white cloth tent used for this purpose were incidentally compared with those under forest canopy. Data on radiation, temperature, humidity, wind, evaporation and the heating of the air, in the open and in a tobacco tent above bare soil and another above tobacco plants, were compared with data on radiation and temperature above and below a plantation of Red and White Pines spaced 4 × 4 m., ca. 20 m. high (base of crown 10 m.) with incomplete crown closure, in Connecticut. Though there are obvious differences in energy budget between the canopy itself and the tent cloth, owing to evapotranspiration etc., the tent approximated to the forest canopy in relations involving the reduction and reflection of radiation, and air and soil temperatures, and it is thought that, with caution, it can be used as a simplified model of the forest canopy. In the forest, solar radiation was reduced somewhat less at midday than earlier or later, whereas in the tent, the angle of the rays made little difference. In both cases, long-wave radiation was affected much less than short-wave by the degree of cloudiness. Mean temperature in the forest at 1·5 m. above ground was 1·5° C. less than in the open, but 0·5° higher on clear nights. Surface temperatures of litter varied by as much as 13° in 20 minutes with the passing of flecks of sunlight.

114. Soil. Soil Science

3944. **Supplemental report of definitions approved by the Committee on Terminology, Soil Science Society of America.** *Proc. Soil Sci. Soc. Amer.* 24 (3), 1960 (235–6). [See *F.A.* 20 No. 1356.]

3945. **First North American forest soils conference, Sept. 8–11, 1958.** Agricultural Experiment Station, Michigan State University, East Lansing. 1958. pp. 226. Many refs.

Includes the following general and review articles, some based on world-wide literature, others concentrating chiefly on N. America: Available water, the key to forest site evaluation (*D. P. White*; 24 refs.); Foliar analysis in tree nutrition research (*D. P. White*; 23 refs.); Controlled soil-moisture experiments in forest tree-water relations (*R. Zahner*; 20 refs.); Plant-soil factors in chemical soil analysis (*G. K. Voigt*; 63 refs.); Physical analysis of forest soils (*S. P. Gessel* and *D. W. Cole*; 20 refs.); Geology and soil in relation to forest vegetation (*H. J. Lutz*; 109 refs.); Mycorrhiza on forest trees (*V. Slankis*; 93 refs.); Diagnosis of nutrient deficiencies by foliar and soil analysis in silvicultural practice (*S. A. Wilde*; 11 refs.). Also regional articles on: Soil-vegetation relationships in the Central Oregon Pumice region (*C. T. Dyrness* and *C. T. Youngberg*); Some soils, vegetation and site relationships of the climatic and sub-climatic Black Spruce forest in northeastern America (*A. Lafond*); Soil-vegetation associations in the Redwood-Douglas-Fir zone of California (*R. A. Gardner*); Soil productivity for hardwood forests of Vermont (*R. A. Farrington* and *M. Howard, Jr.*); Depletion and rehabilitation of a sandy outwash plain in northern New York (*S. O. Heiberg* and *H. Loewenstein*) [supplementing *F.A.* 16 No. 210 and questioning the conclusions of *F.A.* 20 No. 862]; Soil-forest relationships in the site regions of Ontario (*G. A. Hills*) [cf. *F.A.* 12 No. 832]; Interpreting soil surveys for use in growing wood crops (*C. F. Deardorff* and *W. J. Lloyd*) [cf. *F.A.* 17 Nos. 4301–2]. Six papers have been separately abstracted in this issue of *F.A.*

114.1. Soil Physics

See also Nos. 3951, 3967, 3973–4, 3984, 3986, 3988, 4018, 4147–8, 4208–9, 4226–7, 4278, 4391, 4527, 4766.

3946. Viro, P. J. Suomen metsämaiden kivisyydestä. [**Stoniness of forest soil in Finland.**] *Commun. Inst. For. Fenn.* 49 (4), 1958 (1959). pp. 45. 12 refs. [Fi.*e.e.*]

The material for this study of stoniness of firm forest soils in Finland included 4,038 sample plots where stoniness was both measured and estimated, and 11,472 plots where it was estimated only. As compared with measurements by rod-testing [see *F.A.* 16 No. 25], ocular estimation was found to be very unreliable, accuracy proving impossible even after long practice. The distribution of soils of different stoniness classes is tabulated and mapped, and the effect of stoniness on soil fertility discussed. Investigations in *Pinus sylvestris*, *Picea abies* and *Betula verrucosa* stands showed that, on all site classes, fertility decreased with increasing stoniness. Thus stoniness should be taken into account in rating sites.

114.2. Soil Chemistry

See also Nos. 3953–4, 3956–7, 3972–4, 4141–8, 4267, 4278, 4378 *et seq.*, 4391.

3947. Zöttl, H. Methodische Untersuchungen zur Bestimmung der Mineralstickstoffnachlieferung des Waldbodens. [**Investigations on methods of determining the mineral N production of forest soil.**] *Forstwiss. Cbl.* 79 (3/4), 1960 (72–90). 91 refs. [G.]

The author reviews the literature on incubation experiments, and gives an account of his own work [cf. *F.A.* 20 No. 1803; 21 No. 19].

3948. Orfanitskaja, V. G., and Orfanitskij, Ju. A. Ob izmenenii himičeskih svojstv podzolistyh počv pri mehanizirovannoj trelevke lesa. [**Changes in the chemical properties of podzolic soils after mechanized skidding.**] *Lesn. Ž., Arhangel'sk* 2 (1), 1959 (34–43). 10 refs. [Russ.]

Plots were established on clear-felled areas where tractor skidding had been done, in (*a*) the 'fresh', and (*b*) the 'moist' *Piceetum myrtillosum* in the Archangel region. Soil samples were taken from the surface horizons, mixed by such disturbance, at sample points on (1) skidding trails 3 m. wide, (2) those 2 m. wide, and (3) the edges of (1). In both (*a*) and (*b*), the mechanical analyses for (2) and (3) were not greatly different from those of undisturbed soil, but on (1) there was a clear increase in the % of fine particles. In (*a*), the humus content, exchangeable bases, and pH were good for (2), poor for (1), and intermediate for (3). In (*b*), these criteria were not satisfactory for any of the disturbed soils. The results of further investigations made in the *P. myrtilloso-oxalidosum* in the Gorki region are also presented and discussed.

3949. HATCH, A. B. **The effect of frequent burning on the Jarrah (*Eucalyptus marginata*) forest soils of Western Australia**. *Repr.* from *Journal of the Royal Society of Western Australia, Perth* 42 (4), 1959 (97–100). 14 refs.

Examination of the surface soils from regularly burnt firebreaks and adjacent protected compartments in Jarrah forest showed no differences in pH, total soluble salts, organic C, N, exchangeable metal ions, and exchangeable H. The temperatures of these controlled burns are of the order of 320–450° C., the forest soil not being exposed to prolonged high temperatures. If the burning does cause any temporary loss of organic matter and inorganic nutrients from the immediate surface soil, these losses are replaced by natural leaching from the following year's leaf-fall [cf. *F.A.* 17 No. 3578]. *From author's summary.*

114.3. Soil Formation. The Soil Profile and its Development. Litter, Humus etc.

See also Nos. 3962, 3970–1, 3978, 4143–8, 4278, 4391.

3950. PHARES, R. E., and ROGERS, N. F. **Bushel baskets make low cost seed and litter traps**. *J. For.* 58 (5), 1960 (398–9).

The baskets are either screwed to the top of a post or slung between two stakes. A muslin lining within holds the seed or litter that filters through a protective wire screen. Baskets are still serviceable in the Missouri Ozarks after 5 years' continuous exposure; preparation and installation takes 5–9 min., and cost is <$1 per basket.

3951. **Litter-humus changes in North Arkansas.** *Extr.* from *Rep. Sth. For. Exp. Sta. 1959*, 1960 (26–7).

Spraying hardwood woodlands in the Ozarks from the air with 2,4,5-T, plus light grazing, caused a reduction of oven-dry humus weight from 7648 lb. per acre in 1958 to 4238 in 1959, with a resultant storage loss of 218 cu. ft. of water per acre. It required 12 days to air-dry the 1958 litter + humus samples but only 9 days for the 1959 samples. During the same period, litter and humus in an unsprayed forest increased slightly in quantity and retention storage.

3952. LEVINA, V. I. Opredelenie massy ežegodnogo opada v dvuh tipah sosnovogo lesa na Kol′skom poluostrove. **[Determination of the amount of annual litter fall in two types of Pine forest on the Kola peninsula.]** *Bot. Ž.* 45 (3), 1960 (418–23). 5 refs. [Russ.]

The investigations were made in 1947–49 in (*a*) the *Pinetum cladinosum*, and (*b*) the *P. hylocomiosum*. Data are tabulated on weights of the aerial parts of species in the field layer (mainly dwarf shrubs, mosses and lichens) in (*a*) and (*b*), and of the annual litter fall in (*a*) and (*b*). Total annual litter fall (including dead parts of mosses and lichens) was 561 kg./ha. in (*a*), and 947 kg./ha. in (*b*).

3953. VAIČYS, M. Kai kurie Lietuvos TSR maumedynų ir eglynų dirvožemiai ir jų pasikeitimai šių medynų įtakoje. **[Some soils of Larch and Spruce forests in Lithuania, and the influence of the forests on them.]** *Liet. Miškų Ūkio Moksl. Tyr. Inst. Darb.* No. 3, 1958 (205–27). 12 refs. [Lith.russ.]

Investigations were made in pure stands of (*a*) European Larch, and (*b*) Norway Spruce, of various ages and on various soil types. Less litter was produced by (*a*), but there was little difference in chemical composition, except for the greater SiO_2 content of litter of (*b*). Soil acidity was greater under (*b*), while base saturation in the top 150 cm. was $\nless$67–77% under (*a*) and only 21–44% under (*b*). Litter of both species contained more available K than P. Soil microstructure was better under (*a*), the density of the surface soil was greater, and porosity less. The infiltration capacity was greater under (*b*). It is concluded that, under identical conditions in Lithuania, (*a*) has a more favourable effect on the soil than (*b*).

3954. COULSON, C. B., DAVIES, R. I., and LEWIS, D. A. **Polyphenols in plant, humus, and soil. I. Polyphenols of leaves, litter, and superficial humus from mull and mor sites. II. Reduction and transport by polyphenols of iron in model soil columns.** *J. Soil Sci.* 11 (1), 1960 (20–44). 39 refs.

(I) Polyphenols extracted in various ways from fresh green and dried leaves, litter, and superficial humus from mull and mor sites were examined by paper chromatography and paper electrophoresis. The role of polyphenols in mull and mor formation is discussed. (II) The effects of pure polyphenols, and extracts of green leaves, litter, and surface humus in reducing and solubilizing various forms of ferric iron were investigated. The role of polyphenols in the movement of Fe in soils is discussed. *From authors' summary.*

3955. BOCOCK, K. L., *et al.* **Changes in leaf litter when placed on the surface of soils with contrasting humus types. I. Losses in dry weight of Oak and Ash leaf litter**. *J. Soil Sci.* 11 (1), 1960 (1–9). 12 refs.

The dry-weight losses of samples of Oak and Ash litter, enclosed in nylon hair-nets and placed on (*a*) a mull and (*b*) a moder site, were observed for a period of 14 months. Sub-samples of the same Oak litter disappeared at similar rates on the two sites; sub-samples of the same Ash litter disappeared at different rates on the two sites, but always more quickly than Oak litter. On (*a*), the loss of whole Ash leaflets, as well as fragments, was considerable, whereas Oak leaves on (*a*) and (*b*), and Ash leaflets on (*b*), disappeared mainly as small fragments. For both Oak and Ash litter the results from (*a*) were more variable than those from (*b*), suggesting that there are differences in the heterotrophic activity on these sites. [Cf. *F.A.* 19 No. 2642.] *From authors' summary*.

3956. Gilbert, O., and Bocock, K. L. **Changes in leaf litter when placed on the surface of soils with contrasting humus types. II. Changes in the nitrogen content of Oak and Ash leaf litter**. *J. Soil Sci.* 11 (1), 1960 (10–9). 21 refs.

Different trends were found in the changes in composition taking place in sub-samples of the same Ash litter placed in nylon hair-nets on neighbouring sites with (*a*) mull- and (*b*) moder-type humus forms. Similar trends were found for Oak and Ash litter on (*b*). The % N content of Ash litter on (*a*) remained virtually constant during the first 7 months of decomposition, whereas on (*b*) it increased steadily for both litters. The N content of Oak litter is increased by considerable addition from outside. Possible sources are considered. Extraction with hot water of litter at different stages of decomposition showed that the initially large water-soluble fraction, which is poor in N, is leached out more quickly from Ash than from Oak litter. *From authors' summary*.

3957. Sokolov, D. F. Biohimičeskie izmenenija v sostave organičeskogo veščestva lesnogo opada pri razloženii. [**Biochemical changes in the composition of organic matter during litter decomposition**.] *Dokl. Akad. Nauk SSSR* 130 (4), 1960 (912–5). 9 refs. [Russ.] A.P.B.

Tabulates and discusses the results of laboratory and field experiments at Derkul [cf. *F.A.* 16 No. 1349] on the breakdown of leaves of *Acer platanoides*, *Quercus robur*, and a mixture of the two. As decomposition proceeded, there was an increase in pH and in relative and absolute content of substances containing C, and a consequent increase in the % content of N and ash. In laboratory experiments, losses of C compounds after 305 days were greatest in Oak litter and least in Maple. In the field experiments, decomposition went on at virtually the same rate in Oak and Maple, but the mixture decomposed much more slowly. CO_2 evolution was greatest on the Oak litter plot, and next greatest with Maple, but no direct relation was found between the amount of CO_2 being produced and the losses of organic matter during decomposition.

3958. Kurčeva, G. F. Rol′ bespozvonočnyh životnyh v razloženii dubovogo opada. [**Role of invertebrates in the decomposition of Oak litter**.] *Počvoved.* 1960 (4), (16–23). 22 refs. [Russ.e.] A.P.B.

Investigations were made in 1958 on relatively dry Oak forests of the *Aegopodium podagraria* type, on deep, humus-rich chernozems near Kursk. In 140 days, bacteria + fungi alone decomposed only $\frac{1}{10}$ of the Oak litter, while bacteria + fungi + invertebrates decomposed $>\frac{1}{2}$. Earthworms, Enchytraeidae, Acarina and Collembola played the main part in litter decomposition. Study of the excrement of some of the invertebrates seemed to confirm the view that humus substances may be formed during digestion. [Cf. *F.A.* 19 No. 2651; 20 No. 4095.]

3959. Mamaev, B. M., and Sokolov, D. F. Účastie bespozvonočnyh životnyh v estestvennom razrušenii drevesiny duba. [**Role of invertebrates in the natural destruction of Oak wood**.] *Počvoved.* 1960 (4), (24–30). 22 refs. [Russ.russ.e.] A.P.B.

The wood examined consisted of stumps, logs, etc. (1) attacked by brown rots, in the Tula forest reserve, and (2) attacked by white rots, in the Tellerman forest. The succession of invertebrates assisting in the destruction of the wood was determined. The breakdown of wood within the gut of some of the invertebrate species is also discussed on the basis of literature and some original analyses. Four stages (characterized chiefly by the succession: Cerambycidae — Lucanidae — Formicidae — Lumbricidae) are distinguished, the greatest destruction being caused in both localities by larvae of Lucanidae in the second of these stages. Earthworms and millipedes are active in the last stage of destruction.

114.4. Soil Classification. Soil Types

See also Nos. 4138, 4194, 4219, 4378–81, 5208, 5214.

3960. **Conference on the management of wetlands**. Ontario Water Resources Commission, Toronto. 1959. pp. 74. Many refs.

Includes papers on integrated use (*G. Ross Lord*), the water balance of swamps (*D. N. McMullen*), the role of vegetation in the hydrological cycle (*J. Farrar*) [a review, chiefly dealing with forests], wetlands and agriculture (*H. D. Ayers*), wild life (*C. H. D. Clarke*), and requirements for a survey (*A. de Vos*), with discussions.

3961. Jahn, R. Farbbilder typischer Waldboden-Profile des Nordschwarzwaldes. [**Coloured photographs of typical forest soil profiles from the northern Schwarzwald**.] *Mitt. Ver. Forstl. Standortskunde ForstpflZücht*. No. 9, 1960 (36 + 5 photos). [G.]

Illustrates and describes a brown forest soil, a podzolic brown soil, a humus-iron podzol with hardpan, and two stagno-gleys, with brief notes on parent rock, site type, or natural forest type.

3962. Mancini, F. I terreni della foresta di Paneveggio (Trento). [**The soils of the forest of Paneveggio (Trento)**.] *Ann. Accad. Ital. Sci. For.* 8, 1959 (373–454 + 1 map). 60 refs. [It.f.]

A detailed description of the soils; analysis of the foliage of auxiliary species (showing a high % of Ca, though the parent rock is poor in it); a discussion of the extent and causes of podzolization; and suggestions of silvicultural measures to prevent further podzolization.

3963. Yadav, J. S. P. **Soils of the dry zone of India**. *Indian For.* 86 (5), 1960 (274–95). 10 refs.

A general description of dry-zone soils is followed by more detailed descriptions of the soils of individual states. [Cf. *F.A.* 21 No. 4279.]

3964. Dinis, A. Castanheira. Os solos da região da Cela. [**The soils of the Cela region**.] *Agron. angol.* No. 11, 1957/1959 (39–48). 8 refs. [Port.]

Presents observations on the origin and formation, physical and chemical characteristics, and potentialities of the soils of this part of the S. Cuanza region (central Angola), i.e. (1) the lowlands (vegetation mainly Gramineae and Cyperaceae), (2) the lower mountain slopes (Hiemisilva with *Berlinia/Brachystegia* or shrub and orchard savanna with *Acacia sieberiana*, *Ekebergia angolensis* and *Entada abyssinica*), and (3) the high plateaux (originally Hiemisilva with *Brachystegia*, *Berlinia*, *Combretum* and *Uapaca*, but now generally degraded by local agricultural practices to shrub savanna with *Hyparrhenia*).

3965. **A look at Canadian soils**. *Agricultural Institute Review*, *Ottawa* 15 (2), 1960. pp. 92. O.R.E.

A number mainly devoted to a series of articles on the most important soil types of Canada, giving data on their development (in a large % of cases under forest), their present state, the vegetation they carry, and their potentialities for agriculture and forestry.

3966. MARTINI, J. A., *et al.* **Forest soils of Darién Province, Panamá**. *Trop. Woods* No. 112, 1960 (28–39 + 3 photos, 1 folding map). 7 refs.

As a result of a soil survey made in 1959, in which soil collections and profile studies were made at each site where plant material was collected, the soils of the Darién area are roughly divided into 3 groups: (1) the lowland alluvial soils which are subject to flooding (saline Mangrove associations occurring in tidal areas) and are potentially valuable for agriculture; (2) the predominant lactosolic soils occupying most of the hilly and mountainous land, which are mainly limited to use as pasture or forest; (3) the miscellaneous intermediate group of soils called "residual but not lactosolic", occurring in mountain valleys. These are of more recent origin than (2) but are in process of degradation.

114.5. Soil Fertility. Soil Toxicity. Soil Depletion and Exhaustion

See also Nos. 4137–8, 4141–6, 4159, 4267, 4378 *et seq.*, 4391, 4756–62, 4766.

3967. **Pot culture—an approach to site evaluation.** *Extr.* from *Rep. Cent. St. For. Exp. Sta. 1959*, 1960 (68–9).

A technique has been devised that might be used to find out why hardwoods show poor survival and growth when planted on old fields. In a preliminary test, undisturbed soil samples were taken in an old field, a 22-year-old Shortleaf Pine plantation, and a mixed hardwood stand. The Pine site and the old-field site were originally in the same field, and the forest site is adjacent. One-third of the samples from each site (*a*) were sieved through a 2-mm. screen to destroy the soil structure; another third (*b*) were heated to destroy soil micro-organisms; and the remaining samples (*c*) were left undisturbed. *Liriodendron tulipifera* seeds were then sown in pots in the different samples. At the end of 12 weeks, seedlings grown in forest soil (*c*) averaged 9 in. tall—twice as tall as in Pine soil (*c*), and 4 times as tall as in old-field (*c*). Seedlings on all (*a*) samples averaged only 2 in. Results of sterilization were inconclusive. It is concluded that soil structure is perhaps the most important difference between forest and old-field sites. Planted Shortleaf Pine has in 22 years improved old-field soil. As measured by seedling size, plantation soil is intermediate between old-field and forest soil.

114.6. Soil Biology

See also Nos. 3947, 3958–9, 4313, 4378–9.

3968. KUO, H.-C. **[Analysis of the soil microflora in areas under conversion to *Pinus tabulaeformis* and *P. bungeana* and preliminary observations on its influence on Pine sown [directly] on areas previously carrying different [tree] crops.]** *For. Sci.*, *Peking* 1959 (5), (387–402). 10 refs. [Chin.russ.]

The laboratory media found best for the growth of various types of microflora isolated from the site, previously carrying a *Castanea* (*a*) or an *Acer* (*b*) crop, are described, e.g. beef or protein extracts best for *Pseudomonas fluorescens* (especially if acidified) and with cane sugar added, for *Bacillus* spp. While both areas had an abundant microflora, this was especially abundant on (*a*), which had more streptococci. Soil toxicity to nitrifying bacteria was higher in (*b*) than (*a*). In both, N-fixing bacteria were abundant. The relative abundance of the common fungi, e.g. *Penicillium*, *Aspergillus*, *Fusarium*, *Alternaria*, is tabulated.

3969. RAMBELLI, A. Contributo allo studio dei micromiceti nei terreni coltivati ad eucalitto. **[Micromycetes in soils under Eucalypts.]** *Pubbl. Cent. Sper. Agric. For.*, *Roma* No. 3, 1959 (1960), (235–53 + 1 plate). 4 refs. [It.it.e.*e.*]

Of the 29 strains isolated from soils under Eucalypts, some were discovered in the soil for the first time (e.g. *Graphium eumorphum* and *Isaria cretacea*). The antibiotic capacity of the various strains was tested against *Escherichia coli*, *Micrococcus pyogenes*, *Bacillus subtilis* and *Saccharomyces cerevisiae*, and the results are tabulated.

3970. RAMBELLI, A. Qualche indagine sulla microbiologia dei terreni coltivati ad eucalitto. **[Microbiological investigations on soils under Eucalypts.]** *Pubbl. Cent. Sper. Agric. For.*, *Roma* No. 3, 1959 (1960), (217–34 + 2 plates). 2 refs. [It.it.e.*e.*]

A comparative study was made of microbiological activity in soil planted with Eucalypts and in agricultural land under a 5-year rotation, in order to determine the influence of Eucalypt litter on the soil microflora and at the same time to record variations that might have occurred in the course of time. The soil under Eucalypts showed slightly higher aerobic microflora and consequently greater aeration and increased ammonifying and denitrifying capacity, whereas N fixation and nitrification were negligible, and cellulolytic activity was inferior to that of the agricultural land. Since these results differ to some extent from those obtained by Florenzano in 1956 from the same soils [cf. *F.A.* 19 No. 1296], changes are presumed to have taken place since then. In fact the Eucalypt soils are now much more acid than they were at the time of Florenzano's analyses. It is concluded that Eucalypts tend to degrade rather than improve the biochemical and chemical characteristics of the soil. *From author's summary.*

3971. POCHON, J., BARJAC, H. DE, and FAIVRE-AMIOT. **Effect of plantings of *Eucalyptus* on the microflora and humus of soil in Morocco.** *Annales de l'Institut Pasteur, Paris* 97, 1959 (403–6). [F.?] From *abstr.* in *Chem. Abstr.* 54 (4), 1960 (3820). P.R.

An accelerated mineralization of organic matter with a slight formation of humus is associated with a very high activity of cellulolytic bacteria and an absence of N-fixing bacteria. Phenomena of antagonism, in which actinomycetes and fungi play the main part, are important. Climatic factors play more important rôles in the process of mineralization; the shade of Eucalypts is too slight to be significant. [Cf. *F.A.* 21 No. 241.]

3972. CORKE, C. T. **Nitrogen transformations in Ontario forest podzols.** *Proceedings, First North American Forest Soils Conference, East Lansing 1958*, [1959?] (116–21). 20 refs.

Describes studies on the microflora of a brown acid podzol [cf. *F.A.* 17 No. 50] including plots under Maple/Beech treated 8 years earlier with (*a*) superphosphate (160 lb./acre), (*b*) dolomitic limestone (10 tons/acre), and (*c*) both. The number of bacteria in the A_o layer liberating NH_4-N (the major form of inorganic N produced) was greatly increased by treatment, particularly in (*c*). The rates of liberation from forest humus, despite high N contents, are slow. In perfusion nitrification tests, in which equal amounts of N were added to an agricultural soil as (1) $(NH_4)_2SO_4$, (2) casein, and (3) forest humus, the recovery of NO_3-N was 90% after 18 days in (1), 60% in (2), but only 10% after 25 days in (3). N fixation was almost completely non-symbiotic and anaerobic except in boggy areas with *Alnus rugosa* and *Myrica gale*. The number of anaerobic (*Clostridium*) bacteria was greatly reduced in (*a*) and (*b*) and only slightly increased in (*c*). Attempts to add *Azotobacter* spp., including the acid-tolerant *Beijerinckia indica* (*A. indicum*), to samples of these podzols were unsuccessful. Nitrifying bacteria, both the nitrite-producing *Nitrosomonas* spp. and the nitrate-producing *Nitrobacter* spp., were always present in small numbers (2–500 per g. of A_o layer) despite a pH of 3·7–3·9. Their numbers were hardly increased in (*a*), but considerably in (*b*) and (*c*). Even the nitrifying rates of (*b*) and (*c*) soils could be further increased by adding $CaCO_3$ to the perfusion units.

3973. CHASE, F. E. **Manometric studies in agricultural and forest soils.** *Proceedings, First North American Forest Soils Conference, East Lansing, 1958*, [1959?] (122–9). 45 refs.

Reviews the development of manometric methods to study soil respiration and their results, and describes respiration studies on an acid podzol 8 years after fertilizing [cf. preceding abstract]. In samples from the A_o horizon, all three treatments showed higher respiration rates, the highest occurring on the superphosphate plot (*a*). The limestone (*b*) and combined plots (*c*) showed a flatter downward slope of the curve for log. O_2 uptake/time; this, as shown by earlier experiments, indicates that the amount of readily available organic matter (1) must have been reduced in proportion to the more resistant fraction (2). In samples from the B horizon, the control curve was parallel to, though markedly lower than, that for the A_0, indicating similar composition of the organic matter. The curve for (*b*) was higher and steeper than the control, suggesting that some of (1) had been leached to the B layer under the influence of Ca. The curves for (*a*) and (*c*) lay below that of the control, suggesting that when P is added to these P-deficient soils, the breakdown of organic matter in the A_o layer is more complete and less is leached to the B layer.

3974. WITKAMP, M. **Seasonal fluctuations of the fungus flora in mull and mor of an Oak forest.** *Meded. Inst. Toegep. Biol. Onderz. Nat.* No. 46, 1960. pp. 51 + 1 gph. 5 pp. of refs. [E.e.du.]

Presents further data from the Hackfort Oak forest, with its forest-floor types—(*a*) calcareous and (*b*) acid mull and (*c*) mor [cf. *F.A.* 20 No. 1383]. Environmental factors are described in detail. Freshly shed leaves had a quantitatively and qualitatively limited fungus flora; both numbers and species increased with time since shedding. More colonies and species developed from Oak leaves from (*a*) and (*b*) than from (*c*). In the mineral soil of (*a*), fungal plate counts and mycelium growth and concentration were lower, and plate counts of bacteria and actinomycetes higher, than in (*c*), with (*b*) usually intermediate. Fluctuations in numbers of micro-organisms and mycelial growth in the mineral soil were caused by fluctuations in temperature and moisture and by additions of fresh litter, and were similar in (*a*), (*b*) and (*c*). Fluctuations in rate of growth of mycelia and in numbers of bacteria were closely related. The concentration of mycelium in Oak forest was highest in autumn or winter, lowest in spring and summer; this annual fluctuation was not found in a Pine stand. The rate of disappearance of mycelium was almost equal in (*a*) and (*c*), mycolytic and chitin-decomposing micro-organisms predominating in (*a*) and mycelium-feeding oribatid mites in (*c*). Macrofungi appeared in largest numbers ca. 2½ months before the maximum mycelium concentration; in (*a*), the macrofungi were mainly in the humus and litter, and in (*b*) and (*c*) mainly mycorrhizal. Mycelia of *Trichoderma viride*, one unidentified fungus, *Stereum gausapatum* and saprophytic fungi, apparently lignin-decomposing basidiomycetes, inhibited growth of *Bacillus subtilis*. Counts of both fungi and bacteria were increased after breakdown of the litter by the soil fauna.

3975. UBRIZSY, G. Újabb vizsgálatok az erdőtípusok talajlakó nagygombáinak társulási viszonyairol. **[Associations of macroscopic fungi in the soils of different forests.]** *Annales Instituti Protectionis Plantarum Hungarici, Budapest* 7, 1957 (409–44 + 2 tbls.). 39 refs. [Hu.hu.russ.f.] I.M.I.

Recapitulates and supplements earlier research [cf. *F.A.* 11 No. 2481] on the basis of permanent sample plots observed over the seasons in relation to various ecological and climatic factors. Fungus associations (of which several, associated with various forest communities, are described) could serve to characterize forest types where the herbaceous ground flora has been disturbed.

3976. Bekker, Z. Ė., and Suprin, T. P. Issledovanie gribnoj flory lesnyh počv Amurskoj oblasti. **[Investigation of the fungal flora of forest soils of the Amur region.]** *Bot. Ž.* 45 (3), 1960 (404–10). 18 refs. [Russ.russ.]

Investigations were made on soil samples from the area between the Amur and Zeya rivers up to the Tukuringra range [cf. *F.A.* 19 No. 3994] on soils of three groups: (1) brown forest soils under Birch with some Pine, Aspen or Oak; (2) podzolic soils under Spruce or Larch and Pine, with some Birch and Oak; (3) peaty, gley-type soils under Larch and Spruce. A list is included of species identified in cultures. There were no great differences between the species composition of the mycoflora and that of forest soils of similar latitudes in European Russia.

3977. Jahn, E. Ergebnisse von Bodentieruntersuchungen an der Wald- und Baumgrenze bei Obergurgl. **[Investigations into soil fauna near the forest and tree limit at Obergurgl.]** *Cbl. ges. Forstw.* 77 (1), 1960 (26–52). 13 refs. [G.g.]

On 12 sites investigated, the composition of the fauna did not greatly vary. Density was closely related to microclimatic factors, particularly radiation and soil temperature [cf. *F.A.* 21 No. 1317]. In the sites below the forest limit (1950 m. alt.) it was lowest in a bare patch in the centre of a clearing and highest in a shady *Pinus cembra* stand, followed by a sunny Larch stand. In the lower forest ecotone, at 2100 m. alt. there was little difference between 3 sites of different vegetation and exposure, but at 2260 m. the least exposed site with the deepest winter snow cover (*Rhododendretum*) had markedly greater densities than the more exposed *Vaccinietum* or *Alectorietum*. The implications for soil fertility and afforestation are briefly discussed.

3978. Märkel, K., and Bösener, R. Die Bedeutung der Bodentierwelt für den Erfolg von Bestandeskalkungen. **[The importance of the soil fauna for the efficacy of liming in forest stands.]** *Forst u. Jagd* 10 (4), 1960 (179–81). 4 refs. [G.]

In a Spruce stand on gneiss with a raw-humus layer near Tharandt, liming caused a considerable reduction of some oribatid species, particularly those in the lower layers where earthworms, chiefly *Dendrobaena* spp., had become plentiful. These produced a distinct layer of excreta, sometimes reaching down to, but not mixed with, the mineral soil, and greatly improved the structure of the humus layer. On another, poorer, periodically waterlogged site, results of liming were less marked.

114.7. Soil Surveys and Surveying

3979. Ryan, P. **Soil survey in Ireland with particular reference to forestry.** *Irish For.* 17 (1), 1960 (26–36). 8 refs.

A general discussion of soil-survey methods, with particular reference to the problems involved in the proposed Irish national soil survey.

116. Hydrology. Water Conservation, Soil Conservation and Erosion

See also Nos. 3941, 3951, 3960, 4015–20, 4212, 4227, 4355, 4367–71, 4373–4, 4404, 5208, 5215.

3980. **Forests and waters.** *J. For.* 58 (4), 1960 (259–316). 48 refs.

A special number devoted to the management of catchments, including the following: Watershed management on wild lands (*R. E. McArdle*); Watershed management research in Southern California's brush covered mountains (*J. D. Sinclair*); Watershed management research in the Southeast (*J. D. Hewlett* and *L. J. Metz*); Watershed research on the Fraser Experimental Forest (*L. D. Love* and *B. C. Goodell*); Watershed management research in Arizona and New Mexico (*H. G. Reynolds*); Alpine snow research (*M. Martinelli, Jr.*); Research in management of snowpack watersheds for water yield control (*H. W. Anderson*); Watershed management research in the Northeast (*H. W. Lull*); Watershed management research in the Lake States, Intermountain, and Pacific Northwest regions (*E. G. Dunford*); Floods controlled on Davis County watersheds (*G. W. Craddock*); Watershed improvement in the Tennessee Valley (*R. Kilbourne*); Watershed management in the Muskingum Watershed Conservancy District (*B. C. Browning*); Timber and water—twin harvest on Seattle's Cedar River watershed (*A. E. Thompson*); Watershed management in the Department of the Interior: three case studies in cooperation (*G. F. Horne*); Northeast municipal watersheds (*J. M. Heilman*); Educational programmes in watershed management (*R. E. Dils*); Watershed research needs and probable future trends in watershed management (*H. C. Storey*).

3981. Nänni, U. W. **Hints on measuring technique in experimental hydrology.** *Tech. Pap. Dep. For. S. Afr.* No. 1, 1960. pp. 17. 10 refs. [E.e. afrik.]

Outlines some of the difficulties that have been encountered in making hydrological observations, and suggests solutions. Special reference is made to the interpretation of stream-flow phenomena. *From author's summary.*

3982. Lavigne, R. W. **A time-corrector device for adjusting streamflow records.** *For. Res. Note Ntheast. For. Exp. Sta.* No. 98, 1960. pp. 4.

Describes and illustrates a device, accurate to five minutes, for facilitating proportional back-corrections for a total time error disclosed by an automatic recorder. It consists essentially of a 15-day (abscissa)/60-minutes (ordinate) graph on plexiglass, with two arms, i.e. diagonals, pivoted respectively from day 1 and day 8. Its use is exemplified.

3983. Berndt, H. W. **Precipitation and streamflow of a Colorado Front Range watershed.** *Sta. Pap. Rocky Mt. For. Range Exp. Sta.* No. 47, 1960. pp. 14. 5 refs.

Presents data obtained during 1940–58 from the Missouri Gulch catchment (7500–9300 ft. alt.) in the Manitou Experimental Forest, Colo. The purpose of the study was to gain information on water yield and its relation to precipitation in the Ponderosa Pine type. [Cf. *F.A.* 16 No. 2622.]

3984. STOECKELER, J. H., and WEITZMAN, S. **Infiltration rates in frozen soils in Northern Minnesota.** *Proc. Soil Sci. Soc. Amer.* 24 (2), 1960 (137–9). 10 refs.

Tests were made in forests and grassland. The impermeable concrete type of frost was most common in grassland, while the more permeable porous-concrete types were present in the forest, especially in natural Jack and Red Pine stands and in Red Pine plantations.

3985. HARITONOV, G. A. Vodoregulirujuščee vlijanie lesnyh nasaždenij na vodorazdelah vsholmlennogo rel′efa. **[The water-regulating effect of forest stands on watersheds in hilly country.]** *Lesn. Ž., Arhangel′sk* 2 (1), 1959 (4–11). [Russ.]

A general account of the influence of strips of trees on watersheds N.W. of Voronezh on snow accumulation, run-off, infiltration, snow melt, and wind speed. The value of such stands for water conservation varies with geology, climate, species present, etc., and should be considered for each case in relation to such conditions.

3986. KISSIS, T. JA., and POL′SKIJ, M. N. Osobennosti vodnogo režima temnocvetnyh počv bol′ših padin pod drevesnymi nasaždenijami. **[Characteristics of the moisture regime of the dark soils in the great depressions [of the Cis-Caspian lowland] under forest stands.]** *Trud. Inst. Les.* No. 38, 1958 (99–112). 6 refs. [Russ.]

Investigations were made from 1950 to 1955 on (*a*) a "park"-type plantation of 1·8 ha. (>40 species —all specified being hardwoods), and (*b*) some narrow shelterbelts. In 1955 the trees were 16–20 years old. Throughout the period of observation, 16–30% less snow was found on the fields bordering (*b*) and surrounding (*a*) than on areas outside the influence of the trees. The trees used 2–3 times as much water as the grass, and ca. 50% of the total water consumption of (*a*) was from the groundwater. Replenishment of the groundwater under (*a*) and under herbaceous vegetation occurred only after very heavy winter snowfall, but under (*b*) more frequently, though not every year. It seems that (*b*) does better than (*a*), and if stands must be planted, they should be in the lowest, central parts of the depressions where there is most fresh water, and they should be considerably smaller than the area of the depression.

3987. WEST, A. J. **Snow evaporation and condensation.** *Repr.* from *Proceedings, Western Snow Conference 1959*, 1959 (66–73). 5 refs.

Discusses measurement techniques and the effect of various factors. Annual snow evaporation losses varied from 1 to 1·5 in. in a small forest opening (1½ tree-heights across) and from 0·4 to 1 in. under adjacent forest canopy of 70% density. Short-term studies indicated that a large meadow lost about 1½ times, and an exposed ridge about 3 times the amount lost on the small opening.

3988. ANDERSON, H. W., and GLEASON, C. H. **Logging effects on snow, soil moisture, and water losses.** *Repr.* from *Proceedings, Western Snow Conference 1959*, 1959 (57–65). 8 refs.

First results of studies in Fir forests in the Swain mountains and in mixed conifer stands at Onion Creek. In a strip felling (*a*), of 330 × 2500 ft., running N.W.–S.E. at right angles to the prevailing wind, the maximum snow pack contained 7 in. more water than the forest to windward, and 10 in. more than the forest to leeward (i.e. some of the snow in the opening was "stolen" from the adjoining forest to leeward). A block felling (*b*), of 800 × 1800 ft. had ca. 5 in., and a commercial selection felling (*c*), where ca. 35,000 bd. ft. had been removed and 2000 left, ca. 7 in. more snow than the uncut forest. In (*c*) snow melt was faster than in the uncut forest. Summer soil-moisture losses in soils 48 in. deep were decreased by 3·2 in. in (*a*), 2·7 in. in (*b*) and 0·9 in. in (*c*), and estimated water yield increased by 8·6 in. in (*a*), 6·3 in. in (*b*) and 3·4 in. in (*c*). About half the extra water yield of (*a*) and (*b*) as compared with (*c*) was in the form of soil moisture, i.e. in a form which might increase spring and autumn floods. [Cf. *F.A.* 20 No. 4104.]

3989. WOOLDRIDGE, D. D. **Watershed disturbance from tractor and Skyline Crane logging.** *J. For.* 58 (5), 1960 (369–72). 4 refs.

A comparative study was made at the Okanogan National Forest, Wash., of the degree of disturbance caused by logging by (*a*) tractor and (*b*) Wyssen Skyline Crane. Logging by (*a*) left the mineral soil exposed on 22·2% of an area of 750 acres vs. 5·4% by (*b*) on 1000 acres. In the (*b*) area, less damage was found in the residual stand, 1 mile of road was constructed vs. an estimated 10 for standard tractor methods, and damage to drainage channels was eliminated.

3990. KAITH, D. C. **Soil conservation in Bhakra Sutlej catchment.** *Indian For.* 86 (4), 1960 (187–97).

Widespread erosion in the Sutlej catchment, and consequent serious silting, threaten the Bhakra project. Present land uses are outlined, and the chief causes of erosion discussed (fires, defective agriculture, excessive grazing, excessive exploitation of forests by the people, the absence of soil conservation practices in road-building). Remedial measures to be undertaken by the Himachal Pradesh and Punjab State governments are suggested, with an estimate of costs and a discussion of the difficulties involved.

3991. MORLAND, R. T. **Erosion survey of the Hume catchment area. Part VI. Erosion, catchment efficiency and recommendations.** *J. Soil Conserv. Serv. N.S.W.* 16 (1), 1960 (5–30). 17 refs.

Summarizes the erosion status of the catchment area and its efficiency as a source of water to the Hume Reservoir. Recommendations are made for erosion control and land stabilization. [Cf. *F.A.* 21 No. 1391.]

145.7. Insecta. Entomology

See also Nos. 4000–1, 4616 *et seq.*, 5061 *et seq.*

3992. ROSS, D. A. **Abdominal characters of *Dioryctria* pupae (Lepidoptera: Pyralidae) from British Columbia.** *Repr.* from *Canad. Ent.* 91 (11), 1959 (731–4). 1 ref.

3993. SINGH, B. **Description of larva of *Brephos infans* Moeschler (Lepidoptera, Geometridae, Brephinae), with a note on the relationship and affinity of larvae of subfamily Brephinae with larvae of other subfamilies of Geometridae.** *Indian For. Rec.* (*n.s.*) *Ent.* 9 (11), 1960 (211–4). 6 refs.

3994. KOCH, W. Industrie-Melanismus bei der Nonne. **[Industrial melanism in *Lymantria monacha*.]** *Allg. Forstzeitschr.* 15 (18), 1960 (270). [G.]

Presents 3 photographs showing the changes in appearance of *L. monacha* and *Cidaria hastata* which have taken place in German industrial regions in the last 20 or 25 years. These make recognition of even well known species quite difficult at times.

3995. **What insect is this, anyway?** *Extr.* from *Rep. Ntheast. For. Exp. Sta. 1959*, 1960 (37–9).

Experimental crosses of *Pissodes strobi* from White Pine in central New York and *P. approximatus* from Red Pine in Connecticut produced viable offspring in all cases, and the F_1 generation were then mated and back-crossed with both species reared from the original parent stock, and again produced viable offspring. The search for an ecological isolating mechanism in the field is being pursued. The adult beetles are morphologically indistinguishable.

3996. RYAN, R. B. **Termination of diapause in the Douglas-Fir beetle, *Dendroctonus pseudotsugae* Hopkins (Coleoptera: Scolytidae), as an aid to continuous laboratory rearing.** *Repr.* from *Canad. Ent.* 91 (8), 1959 (520–5). 4 refs. (*Tech. Pap. Ore. Agric. Exp. Sta.* No. 1204.)

Describes a method of rearing several generations per year, by the use of cold treatments.

3997. SCHEDL, K. E. **Indian bark and timber beetles I. 160. Contribution to the morphology and taxonomy of the Scolytoidea.** *Indian For. Rec.* (*n.s.*) *Ent.* 9 (7), 1957 (1958), (163–9).

A revision of the Indian species of *Scolytus* together with the description of two new species and a new form (*S. kashmirensis*, *S. chelogaster*, and *S. rugulosus* var. *baluchistani*). [Cf. *F.A.* 21 No. 51.]

3998. NONVEILLER, G. *Amphimallon assimilis* i problem njegovih varijeteta. **[*A. assimilis* and the problem of its varieties.]** *Zašt. Bilja* No. 51, 1959 (119–31). 27 refs. [Serb.g.*g*.] I.M.I.

Details of morphology, physiology and habits are adduced to support the conclusion that *A. assimilis* and *A. burmeisteri* are distinct species.

3999. CARNE, P. B. **A review of the Australian Rutelinae (Coleoptera: Scarabaeidae).** *Aust. J. Zool.* 6 (2), 1958 (162–240). 14 refs. O.R.S.

Includes keys to tribes, subtribes, genera and species. Two new genera and 13 new species are described, and 4 new synonyms recorded.

15. Animal Ecology. Game and Fish Management. Hunting, Shooting and Fishing

See also Nos. 3960, 4186–7, 4604 *et seq.*, 5174, 5190.

4000. CLARK, R. C. **A method of adapting a microscope for observation of non-motile insects on tree trunks.** *Repr.* from *Canad. Ent.* 92 (1), 1960 (79–80).

An old-style binocular microscope with a U-shaped base was removed from the base and attached to small metal plates that had previously been fastened to the tree stem. Illumination was provided by a flash-light on a light metal arm attached to the microscope body.

4001. GRAVES, R. C. **Ecological observations on the insects and other inhabitants of woody shelf fungi (Basidiomycetes: Polyporaceae) in the Chicago area.** *Annals, Entomological Society of America, Columbus, Ohio* 53 (1), 1960 (61–78). 78 refs. O.R.S.

Lists animals collected from 13 species of Polyporaceae, including nematodes, snails, and arthropods of 14 orders. Acarina, Collembola, and Coleoptera were the dominant orders, certain species of Diptera, Corrodentia, Thysanoptera and parasitic Hymenoptera also being important. A definite succession was noted in the fauna with attack and decomposition of the fungal habitat. The ecological observations include a review of the literature.

4002. MARTIN, N. D. **An analysis of bird populations in relation to forest succession in Algonquin Provincial Park, Ontario.** *Ecology* 41 (1), 1960 (126–40). 12 refs.

In order to determine some of the possible relationships between forest succession and bird populations in the park, censuses of breeding birds were taken, using the spot-map method, in most of the major forest types during the breeding seasons of 1952–53. The approximate areas of the bird territories were measured and the vertical depth of territories determined by recording heights above the ground at which birds were observed. From these data, approximations of average territory volume were obtained for a number of species. Distinct bird communities were recognized in (*a*) bog, (*b*) boreal forest, (*c*) *Tsuga* forest, and (*d*) deciduous forest. Total bird populations per 100 acres were 286 territorial ♂s of 13 species in (*a*), 232 of 32 species in (*b*), 279 of 28 species in (*c*), and 168 of 18 species in (*d*).

4003. HAGAR, D. C. **The interrelationships of logging, birds, and timber regeneration in the Douglas Fir region of north-western California.** *Ecology* 41 (1), 1960 (116–25). 15 refs.

Clear felling of blocks of 10–20 acres in a virgin stand of Douglas Fir in N.W. California, leaving intervening blocks of similar size, caused a definite increase in bird population and a marked change in species composition. There was little change in total number of species at first, but an increase occurred within 3 years after cutting. The junco became predominant on clear-felled blocks where an abundance of weed seeds, berries and insects helped the population to flourish. These birds turned largely to Douglas Fir seed when it was available. Other important seed-eaters which invade logged areas to forage on the ground were varied thrush, spotted towhee, mountain quail, golden-crowned sparrow, and fox sparrow. Steller jays and winter wrens were also important in the ecology of logged areas, but the former bird was not a harmful influence in Douglas Fir regeneration. Several species of finch, the redbreasted nuthatch, and the chestnut-backed chickadee attacked the cones of seed-producing trees round the margins of felled blocks. Many other species of bird were affected by logging. *From author's summary.*

4004. RICKARD, W. H. **The distribution of small mammals in relation to the climax vegetation mosaic in eastern Washington and northern Idaho**. *Ecology* 41 (1), 1960 (99–106). 18 refs.

During the summers of 1954 and 1955, 24 stands representative of 14 relatively undisturbed climax plant associations (including the *Pinus ponderosa*, *Pseudotsuga*, *Thuja/Tsuga*, and *Picea/Abies* zones) were sampled for their small mammal species composition. During 14,175 trap-days, 600 small mammals, representing 11 species, were trapped. The distribution of each species is discussed in relation to occurrences in the stands sampled. *From author's summary.*

4005. KREFTING, L. W., and SHIUE, C.-J. **Counting deer pellet groups with a multiple-random-start systematic sample**. *Minn. For. Note* No. 89, 1960. pp. 2. 1 ref.

The technique, which is described, was applied with highly satisfactory results on a 6000-acre deer yard in N.E. Minnesota and on the Upper Peninsula Experimental Forest, an 11,200-acre tract in Michigan. [Cf. *F.A.* 21 No. 3538.]

16. General Botany

160. Plant Chemistry

See also Nos. 3954, 4026–8, 4136, 4140–1, 4143–6, 4149, 4159, 4171, 4294, 4380, 4686, 4709, 4908 *et seq.*, 5140 *et seq.*

4006. ALLEN, M. **A rapid method of measuring the magnesium content of large numbers of individual leaves.** *Extr.* from *Rep. E. Malling Res. Sta. 1958/59*, 1960 (116–7). 4 refs.

A rapid Titan Yellow method for the estimation of Mg in large numbers of single leaf samples is described: 144 determinations can be carried out within 2 hours by one assistant. *Author's summary.*

4007. HATCHER, J. T. **Wet digestion of plant material gives low boron values.** *Analyt. Chem.* 32 (6), 1960 (726). 3 refs. O.R.S.

It is concluded from tests on samples (including Silver Maple and Elm leaves) that the wet digestion method is not satisfactory for determining B in plant materials.

4008. DOWD, L. E. **Spectrophotometric determination of quercetin**. *Analyt. Chem.* 31 (7), 1959 (1184–7). 11 refs. O.R.S.

Presents a method for determining quercetin based on the formation of a coloured complex with $AlCl_3$. Linear response is obtained between 2 and 15 γ quercetin per ml., with absorption measurements at 430 $m\mu$. The method, developed for process control and measurement of purity of quercetin produced from Douglas Fir bark, is applicable to quercetin from all sources.

4009. KARIYONE, T., *et al.* **[Chemical constituents of the plants of Coniferae and allied orders. XXXIII. On the new glycoside, distichin and other constituents of the leaves of *Taxodium distichum*.]** *J. Pharm. Soc. Japan* 80 (1), 1960 (102–5). 10 refs. [Jap.e.*e.*] O.R.S.

[Cf. *F.A.* 20 No. 2742.] Methanol extraction gave avicularin, quercetin, sequoyitol and the new flavonoid glycoside, distichin. *From authors' summary.*

4010. PRISTA, L. NOGUEIRA, ALVES, A. CORREIA, and ARAÚJO, M. FÁTIMA CORREIA DE. *Cassia occidentalis* L.—estudo dos seus compostos antraquinónicos. **[*C. occidentalis*—a study of its anthraquinone compounds.]** *Garcia de Orta, Lisboa* 7 (4), 1959 (757–72). 33 refs. [Port.f.e.] E.M.B.

Presents a quantitative chemical analysis of the anthraquinone compounds found in roots, seeds and leaves of *C. occidentalis* from Angola, Portuguese Guinea and S. Tomé. *From authors' summary.*

4011. DABHOLKAR, M. V. **Studies in the buffer systems of certain nitrophilous plants of India. I. Buffer index curves for the root sap of *Amaranthus spinosus* Linn., *Croton sparsiflorus* Morong. and *Amaranthus viridis* Linn.** *Travaux de la Section Scientifique et Technique, Institut Français de Pondichéry, Pondichéry* 1 (3), 1959 (118–28). 8 refs. [E.f.]

A study based on Small's buffer-complex classification [cf. *F.A.* 16 No. 27], showing that the buffer complexes of the 3 species are amino compounds, oxalates, citrates, malates, succinates, bicarbonates, and phosphates, which classifies them as alkali-tolerant. These species can therefore be considered indicators of slightly alkaline soils, in addition to their role as indicators of soils rich in N. *From author's summary.*

161. Physiology

See also Nos. 3937, 3967, 4059, 4070, 4135 *et seq.*, 4331–2, 4340, 4344, 4542–4, 4552, 4859, 4872–4.

4012. **Annual review of plant physiology. No. 11.** Annual Reviews Inc., Palo Alto, Calif. 1960. pp. viii + 468. Many refs. Price $7.00 in U.S.A., $7.50 elsewhere.

Includes the following review articles, containing many references to forest trees: The submicroscopic structure of the cell (*F. Mercer*); Nitrogen fixation (*C. S. Yocum*); Energy transfer through phosphorylation mechanisms in photosynthesis (*O. Kandler*); The primary processes of photosynthesis in plants

(*A. A. Krasnovsky*); Biosynthetic pathway of aromatic compounds (*A. C. Neish*); Heat transfer between the plant and its environment (*K. Raschke*); The relationship between salt uptake and the absorption of water by intact plants (*R. Scott Russel* and *D. A. Barber*); Transport in the xylem (*E. G. Bollard*); Transport in the phloem (*M. H. Zimmermann*); Vernalization and its relations to dormancy (*P. Chouard*); The mechanism of action of auxin (*A. W. Galston* and *W. K. Purves*); Gibberellins as native plant growth regulators (*B. O. Phinney* and *C. A. West*); Pectic and cellulytic enzymes in plant disease (*R. K. S. Wood*); Physics and chemistry of protoplasmic streaming (*N. Kamiya*).

4013. WALKER, L. C. **Isotope tracer methods in tree nutrition**. *Proceedings, First North American Forest Soils Conference, East Lansing 1958*, [1959?] (25–30). 25 refs.

Reviews previous research and reports on a study in which 12 Loblolly Pines in a 3-year plantation were treated with P^{32} by spraying the milliacre surrounding each plant with P_2O_5 in water at a rate of 100 lb./acre. P^{32} was taken up shortly after treatment and continued to be taken up and stored for at least 30 days. P content of needles after 2 days was greatest at the bottom of the crown, where it was much greater in 1-year-old than in the current year's needles. Later, there was no consistent picture as to levels in age groups. A chemical extraction method determined P content more precisely than a ground-tissue method. Within 15 days much P had been leached to a depth of 3 in. in the soil, an eroded gravelly clay loam, but virtually none to 4 in.

4014. ZGUROVSKAJA, L. N. Anatomo-fiziologičeskoe issledovanie vsasyvajuščih, rostovyh i provodjaščih kornej drevesnyh porod. [**Investigations on the anatomy and physiology of absorbing, extension and conducting roots of woody species**.] *Trud. Inst. Les.* No. 41, 1958 (5–32). 39 refs. [Russ.]

[Cf. *F.A.* 20 No. 258.] Describes and illustrates the structure of the three types of roots in *Fraxinus excelsior*, *Acer platanoides*, *Quercus robur* and *Pinus sylvestris*, at ages of 4 months, 1–3 years, 17 and 50–80 years, growing near Moscow and at Derkul [cf. *F.A.* 17 No. 1207]. Discusses also the suction force of the root tips, the ratio of absorbing surface to evaporating surface in *P. sylvestris*, and starch content in absorbing and conducting roots.

4015. BLISS, L. C. **Transpiration rates of arctic and alpine shrubs**. *Ecology* 41 (2), 1960 (386–9). 13 refs.

Transpiration rates for species of Willow, Alder, and Dwarf Birch shrubs were measured by the potometer method in the arctic tundra of northern Alaska and the alpine tundras of Wyoming and New Hampshire. At the same time, data were collected on air and soil temperature, vapour pressure deficit [VPD], wind, and cloud cover. On a diurnal basis, water losses were directly related to air temperature, VPD, and wind speeds below 6 m.p.h., and inversely related to cloud cover and wind speeds above 6–8 m.p.h. Although different species were measured under different atmospheric conditions, transpiration rates per unit leaf area for the shrubs were highest in New Hampshire, lowest in Wyoming and intermediate in Alaska. In general, Willow transpiration rates were lower than those for Birch, with Alder intermediate. *Author's summary*.

4016. GULIDOVA, I. V. Transpiracija derev'ev i trav v zone srednej tajgi i ee zavisimost' ot meteorologičeskih uslovij. [**Transpiration of trees and herbaceous species in the central taiga zone, and its relation to meteorological conditions**.] *Trud. Inst. Les.* No. 41, 1958 (111–21). 13 refs. [Russ.]

[Cf. *F.A.* 20 No. 4059.] Using Ivanov's rapid weighing method, transpiration measurements were made in forests or clear fellings at four sites in the Vologda region. Species involved were Spruce (5–10, 20 and 100–140 years old), Birch and Aspen (7–8, and 15), Alder and Willow coppice (7–8), and *Epilobium* sp., *Calamagrostis* sp., etc. It was found that, under normal conditions of good water supply, the transpiration rate (t.r.) was governed by light and temperature. Over the growing season, the mean t.r. in sunny weather averaged almost twice that in cloudy weather. At the same temperature, t.r. was 40–60% greater with the sun visible than with it obscured. In Spruce and Birch, t.r. was virtually unchanged over the range 15–26° C.; in Aspen, Alder and *Epilobium* it varied sharply with temperature. Precipitation in this region exceeds transpiration: on forested areas with no surface run-off, surplus water amounts to 300–400 mm. p.a.; on clear-felled areas, even with a second growth of deciduous trees and herbaceous species, it is ca. 500 mm.

4017. CEL'NIKER, JU. L. O pokazateljah vodnogo režima list'ev drevesnyh porod stepnoj zony. [**Indices of the moisture regime of leaves of woody species in the steppe zone**.] *Trud. Inst. Les.* No. 41, 1958 (33–54). 91 refs. [Russ.]

In studies complementary to those on transpiration [cf. *F.A.* 19 No. 1349], the following were investigated as indices of the moisture regime of leaves of the same 3 species growing in the Derkul steppe: leaf moisture content, moisture deficit, osmotic pressure, and suction force. Their relationships with each other and with soil m.c. are shown in graphs. Results suggest that the earliest and most suitable indicators of the plant's moisture supply are the osmotic pressure and transpiration rate, the latter falling as the former increases when the soil becomes dry. Transpiration measurements to determine moisture supply should be made only on hot, clear days.

4018. CEL'NIKER, JU. L. O vodnom režime lesnyh nasaždenij v stepi v pervye godi ih žizni. [**The moisture regime of forest stands in the steppe during the first few years**.] *Trud. Inst. Les.* No. 41, 1958 (87–95). 14 refs. [Russ.]

Investigations were made from 1952 to 1956 on the transpiration of *Quercus robur*, *Fraxinus pennsylvanica*, *Acer platanoides*, etc. in the nursery (1- to 3-year plants) and in shelterbelts (4- to 6-year plants) on chernozems at Derkul. The rate of transpiration was found to be 2–8 times that of mature trees at the same soil moisture content, and to vary inversely with soil m.c. The osmotic pressure of the cell sap of young trees was usually 15–20 atm., and the suction force of the leaves 10–20 atm. Moisture loss by evapotranspiration at age 1–3 years was less than the total moisture supply (soil water in the spring plus precipitation during the growing season). At 5–6 years the trees were using all the water available in the soil.

4019. Silina, A. A. Vlijanie transpiracii odnih drevesnyh porod na transpiraciju drugih pri sovmestnom ih proizrastanii v lesostepi. **[Influence of the transpiration of some tree species on that of others, when growing together in the forest-steppe zone.]** *Trud. Inst. Les.* No. 41, 1958 (96–103). 11 refs. [Russ.]

A study of the competition for water by *Quercus robur*, *Fraxinus excelsior* and *Acer platanoides* in the Tellerman forest in 1954–55. On the basis of these results and the conclusions of other workers, the author recommends reducing Ash competition by thinnings and selection fellings so as to leave the Oak in individual groups. As an associate species, the Maple can be present in any quantity, but the Ash only to a limited extent.

4020. Hlebnikova, N. A. Vodnyj režim derev′ev na raznyh opuškah i vnutri nasaždenija. **[The moisture regime of trees at different margins of a stand, and within the stand.]** *Trud. Inst. Les.* No. 41, 1958 (55–70). 19 refs. [Russ.]

Investigations were made in 1955 in small pure stands of (1) *Ulmus pumila* var. *arborea*, (2) *Acer negundo*, and (3) *Fraxinus pennsylvanica*, planted in 1951 at Dzhanybek, W. Kazakhstan. Leaf moisture content, transpiration rate, ratio of weight of sun leaves to shade leaves, and the diurnal variation in transpiration, were determined for trees at the N., S., E. and W. margins of the stands, and within the stands, and from these were calculated the total transpiration losses of individual trees and of the stands as a whole. The transpiration rate at the margins, especially the S., W. and E., was greater than that within the stand. Strong direct sunlight, if it lasted most of the day, depressed transpiration in all 3 species, (1) being the most, and (2) the least, resistant. Transpiration loss in 1955 was 364 mm. in (1), 341 mm. in (2), and 212 mm. in (3); of this, 14–24% was transpired by the marginal rows. Removing half the trees (by cutting out every alternate row in thinning) increased the rate of transpiration but reduced total transpiration loss to 45% of that in unthinned (2), and to 76% of that in unthinned (1).

4021. Stiles, W. **Respiration. III.** *Bot. Rev.* 26 (2), 1960 (209–60). 144 refs.

[Cf. *F.A.* 8 No. 80.] A further supplementary review of literature, dealing with: research methods; effects of external conditions on respiration; growth regulators and respiration; the respiratory substrate; respiration of different kinds of tissue; respiration and cell division and fusion; anaerobic respiration (fermentation); and the mechanism of respiration.

4022. Saeki, T. **Interrelationships between leaf amount, light distribution and total photosynthesis in a plant community.** *Bot. Mag., Tokyo* 73 (860), 1960 (55–63). 20 refs. [E.e.jap.] I.M.I.

Reviews the literature and attempts to improve the methods and equations in determining these relationships for whole communities, with a view to estimating total photosynthesis. A comparison is made of data from a stand of *Zelkova serrata* (taking account of the different photosynthetic activity of sun- and shade-leaves) and from a stand of annual plants (*Celosia cristata*).

4023. Nomoto, N., Kasanaga, H., and Monsi, M. **Dry matter production by *Chamaecyparis pisifera* in winter.** *Bot. Mag., Tokyo* 72 (857/858), 1959 (450–5). 14 refs. [E.e.jap.] I.M.I.

Photosynthetic activity and dry-matter production during the winter were investigated on cut twigs of *C. pisifera*, using (*a*) twigs that had turned brown and (*b*) twigs that had remained green. It was found that the chlorophyll content of (*a*) was only half that of (*b*). Net photosynthetic rate of (*b*) was positive, though only $\frac{1}{3}$ of the summer rate. Net photosynthetic rate of (*a*) was markedly depressed [only half that of (*b*)], and light compensation point very high. Positive productivity could be observed in (*b*) only with moderately low temperatures (5–10° C.), when dry-matter production was ca. $\frac{1}{6}$ of maximum summer productivity. The productivity of (*a*) could be only $\frac{1}{15}$ of the summer value. *From authors' summary.*

4024. Dadykin, V. P., and Bedenko, V. P. O geografičeskoj izmenčivosti optičeskih svojstv list′ev rastenij. **[The geographical variability of the optical properties of plant leaves.]** *Dokl. Akad. Nauk SSSR* 130 (3), 1960 (674–7). 18 refs. [Russ.] A.P.B.

[Cf. *F.A.* 21 No. 2731.] Graphs the spectral transmission and reflection of radiant solar energy by leaves of *Salix caprea* and *S. glauca* at three widely separated locations on a meridian in the E. of the U.S.S.R. (Tiksi, Yakutsk, Blagoveshchensk), and of *Corylus avellana* and *Tilia cordata* on a meridian in the W. (Khibiny, Moscow, S. Crimea). *Pinus sylvestris* and *Betula verrucosa* were also examined on the W. meridian, but results are not reported here. Differences between the curves from the various locations for reflection and transmission were small in the visible part of the spectrum, but considerable in the range of longer wavelengths, i.e. at $\geqslant 680$ mμ. Reflection and transmission were always greatest at the southernmost, and least at the northernmost, points of observation, thus confirming that the proportion of radiant energy absorbed by the leaves increases from S. to N., i.e. with increasing severity of climate.

4025. Hlebnikova, N. A. Osobennosti fotosinteza derev′ev v raznyh častjah nasaždenija. **[Features of the photosynthesis of trees in different parts of the stand.]** *Trud. Inst. Les.* No. 41, 1958 (71–86). 33 refs. [Russ.]

In investigations complementary to those already reported [see *F.A.* 21 No. 4020] on the same sites, the rates and diurnal variations of photosynthesis and respiration, the dry-matter increment, and the C balance were determined for the various parts of the stands. Photosynthesis was greatest in *Ulmus pumila* var. *arborea* (1), and least in *Acer negundo* (2). The rates of photosynthesis and respiration were greater at the margins and in the thinned part of the stands, than in the unthinned part. In (2), maximum photosynthesis was observed in the early mornings, strong insolation and high temperatures depressing photosynthesis and increasing respiration. In (1), photosynthesis was increased by direct insolation, but even so, there was a drop in the late morning; *Fraxinus pennsylvanica* (3) resembled (1) in this respect, the drop occurring at mid-day. In the unthinned part of the stands, all three species showed a single-peaked photosynthesis curve. There was a close connexion between changes in stomatal width and the diurnal variation in photosynthesis. In the more light-demanding species, more of the products of photosynthesis went towards wood formation. Of the total amount of C used in increment in 1955, 26% was deposited in the wood in (1), 19% in (3), and 18% in (2).

4026. PHILLIPS, I. D. J., and WAREING, P. F. **Studies in dormancy of Sycamore. II. The effect of daylength on the natural growth-inhibitor content of the shoot.** *J. exp. Bot.* 10 (30), 1959 (504–14). 7 refs. O.B.D.

An investigation was made into the effect of day length on the inhibitor content of first-year seedlings of *Acer pseudoplatanus*. The shoot apical regions and mature leaves were extracted with 80% aqueous methanol, fractionated by paper chromatography in isopropanol/ammonia and assayed by the wheat-coleoptile growth test. A growth inhibitor was present in all extracts at R_f 0·7. Higher levels of inhibitor were present in both apices and mature leaves of plants transferred to short-day conditions than in those maintained under long days throughout. These differences in inhibitor level can be detected after 2–5 days of short-day treatment, preceding any marked effect of day length on growth. Evidence is adduced in support of the hypothesis that the inhibitor is produced in the leaves during darkness and is transported to the apex during the photoperiod. [Cf. *F.A.* 20 No. 2776.] *From authors' summary.*

4027. SNOW, A. G., JR. **Hormones and growth regulators can be useful to foresters.** *Sta. Pap. Ntheast. For. Exp. Sta.* No. 130, 1959. pp. 14. 44 refs.

A short review, with chiefly U.S. references, of their various possible uses in forest and catchment management, and in the control of forest fires, insects and diseases.

4028. MURAKAMI, Y. **A paper chromatographic survey of gibberellins and auxins in immature seeds of leguminous plants.** *Bot. Mag., Tokyo* 72 (848), 1959 (36–43). 13 refs. [E.e.jap.] I.M.I.

Studies the distribution of gibberellins and auxins in immature seeds of 15 legumes (including *Robinia pseudoacacia*, *Cytisus scoparius*, *Maackia amurensis*, *Sophora angustifolia*, *Cercis chinensis* and *Albizzia julibrissin*), and shows in histograms the gibberellin-like and auxin-like activity of ether extracts of each.

4029. ROBBINS, W. J., and HERVEY, A. **Wood extract and growth of *Morchella*.** *Mycologia* 51 (3), 1959 (356–63). 16 refs. O.R.S.

Growth of *M. esculenta* and *M. crassipes* in a medium of mineral salts, dextrose, casein hydrolysate, B vitamins and purine and pyrimidine bases at pH 4·5 was slight. It was markedly increased by the addition of natural preparations, especially a water extract of dry Beech wood. Wood extract was effective also at neutral reactions. The presence in this natural material of an unidentified growth substance(s), in which *Morchella* is partially deficient, is suggested, and some characterization of the substance(s) is given.

4030. VIHROV, V. E. Dviženie vetvej derev′ev. **[Movement of the [dead] branches of trees.]** *Priroda, Moskva* 49 (1), 1960 (127–8). 2 refs. [Russ.] A.P.B.

Discusses the difference in the rates at which the tension and compression wood in dead conifer branches absorb and release atmospheric moisture, so causing the branches to bend up or down, and the relation of this phenomenon to current and future weather conditions.

4031. KRJUČKOV, V. V. O mikroklimate rastenij. **[The microclimate of plants.]** *Bot. Ž.* 45 (3), 1960 (321–34). 56 refs. [Russ.e.]

On the basis of his own studies and those of others [cf. *F.A.* 21 No. 1442], the author concludes that plants have their own hydrothermal regime, which he calls the "microclimate" of the plant; in particular, each individual plant has its own temperature (depending on its colour, mass, moisture content and exposure to direct radiation, as well as on air temperature, r.h., etc.) which differs from the air temperature. Supporting data are given for Birch and Spruce stems, twigs and leaves. The disparity between conditions for growth in mountainous temperate regions and flat Polar regions, transpiration at sub-zero air temperatures, and concepts such as the "growing season" and "sum of effective temperatures" (i.e. those > 10° C.), are discussed in the light of these findings.

163. Embryology

See also Nos. 4099, 4116.

4032. HÅKANSSON, A. **Seed development in *Larix*.** *Bot. Notiser* 113 (1), 1960 (29–40). 11 refs. [E.e.] O.B.D.

Investigations of *Larix decidua*, *L. leptolepis* and *L. sibirica* showed that the embryo had attained full size in early or middle August, and that food storage in the endosperm was completed before the end of that month. Development was most rapid in *L. sibirica*. The seed usually had only one embryo. Several, and sometimes all, archegonia of the ovule are not fertilized, and a variable number of ovules are without an embryo. A second cause of seed sterility is embryo mortality during certain stages of development, and, in *L. sibirica*, abnormal embryos which arise mainly in connexion with polyembryony. *From author's summary.*

4033. Takao, A. **A cytochemical study on the proteid vacuoles in the egg of *Pinus thunbergii* Parl.** *Bot. Mag., Tokyo* 72 (853/854), 1959 (289–97). 12 refs. [E.e.jap.] I.M.I.

The 'proteid vacuoles' in the cytoplasm of the egg cell of *P. thunbergii* were studied by staining methods, and their nutritive significance in the maturation of the egg cell and in the early development of the proembryo is discussed. *From author's summary.*

4034. Black, T. M. **Abnormal seedlings of *Pinus contorta* Loudon.** *Scot. For.* 14 (2), 1960 (81–6 + 3 photos). 9 refs.

A detailed description of two cases of abnormal germination, one concerned with the phenomenon of polyembryony, and the other with a reversed embryo.

4035. Baker, H. G. **Apomixis and polyembryony in *Pachira oleaginea* (Bombacaceae).** *Amer. J. Bot.* 47 (4), 1960 (296–302). 27 refs. O.B.D.

Seeds of *P. oleaginea* from Ghana were found to contain 1–5 embryos in a single seed. The flowers are self-compatible but need to be pollinated before seed will set. One embryo in each seed is usually much the largest and is the only one to become established. There is no relationship between seed size and the numbers of embryos. Adventitious embryony is responsible for the excess embryos, following the formation of a normal sexually produced embryo ($2n = 72$) and endosperm ($3n = 108$). The adventitious embryos arise from single cells in the nucellus in the vicinity of the micropyle, and appear to develop faster than the sexually produced embryo, with consequent frequent apomictic reproduction. This is the first report of apomixis in the Malvales. Maturation of the fruit takes ca. 2 months, but the seeds germinate soon after shedding. *P. oleaginea* may fruit 3 years after sowing. These facts may be important for seed production. *From author's summary.*

4036. Corti, R. Richerche sul ciclo riproduttivo di specie del genere *Quercus* della flora italiana. IV. Osservazioni sulla embriologia e sul ciclo riproduttivo in *Quercus ilex* L. **[The reproductive cycle of Italian species of *Quercus*. IV. Embryology and the reproductive cycle in *Q. ilex*.]** *Ann. Accad. Ital. Sci. For.* 8, 1959 (19–42 + 5 plates). 15 refs. [It.f.] [Cf. *F.A.* 18 No. 220.]

164. Morphology

See also Nos. 4014, 4058, 4069, 4073, 4099, 4107, 4157, 4163, 4173, 4331.

4037. Shutts, C. F. **The comparative morphology of the Hernandiaceae.** *Abstr. of thesis*, in *Dissert. Abstr.* 20 (10), 1960 (3938). O.R.S.

Studies were made of sections and/or diaphanized preparations of the wood, leaves, leaf nodes, pollen, flowers and inflorescences of representative species in order to determine taxonomic relationships. The gross morphology of the fruits and the distribution of the genera were also studied.

4038. Purnell, H. M. **Studies of the family Proteaceae. I. Anatomy and morphology of the roots of some Victorian species.** *Aust. J. Bot.* 8 (1), 1960 (38–50 + 9 plates). 15 refs. O.B.D.

4039. Agaev, Ju. M. Neobyčnye pobegi u ėl′darskoj sosny. **[Unusual shoots on *Pinus eldarica*.]** *Priroda, Moskva* 49 (2), 1960 (94–5). [Russ.] A.P.B.

Shoots with the single primordial leaves of the seedling stage continue to form on *P. eldarica* up to the age of 10–15 years, along with normal shoots.

4040. Scholz, E. Blütenmorphologische und -biologische Untersuchungen bei *Acer pseudoplatanus* L. und *Acer platanoides* L. **[Morphological and biological studies on flowers of *A. pseudoplatanus* and *A. platanoides*.]** *Züchter* 30 (1), 1960 (11–6). 5 refs. [G.g.] E.M.B.

In studies on a total of 113 trees, considerable variations (illustrated by photographs) were found in flower morphology within the two species; flower types included the normal ☿s, apparent ☿s in which the anthers failed to open and finally died off, and ♂ flowers bearing anthers but lacking a pistil. A study of the sex distribution of the trees showed that both species are passing from monoecism to dioecism, the change being further advanced in *A. pseudoplatanus*. On some trees of both species, the sex distribution of the flowers remained constant from year to year, whereas on others there were annual variations.

4041. Canright, J. E. **The comparative morphology and relationships of the Magnoliaceae. III. Carpels.** *Amer. J. Bot.* 47 (2), 1960 (145–55). 16 refs. O.B.D.

Describes the morphology and vascular anatomy of the carpels of 49 species in 9 of the 10 genera of this family. Among the material examined, the carpels of the genera *Elmerrillia* and *Manglietia* were found to retain the most primitive features, those of *Liriodendron* to possess the most advanced [cf. *F.A.* 15 No. 1096; 17 No. 790]. *From author's summary.*

4042. Bailey, I. W. **Some useful techniques in the study and interpretation of pollen morphology.** *J. Arnold Arbor.* 41 (2), 1960 (141–8 + 3 plates).

Discusses the utility and reliability of ruthenium red, the occurrence and distribution of cellulose in pollen, and the solubility of the exine of pollen in monoethanolamine.

4043. Yamazaki, T., and Takeoka, M. **[Electron microscope investigations on the surface structure of the pollen membrane based on the replica method. VI. Gymnospermae—1.]** *Sci. Rep. Kyoto Prefect. Univ. (Agric.)* No. 11, 1959 (86–90 + 3 plates). 10 refs. [Jap.e.*e.*]

Gives details of the fine structure of the pollen-membrane surfaces of 5 species of Gymnospermae viz. *Cycas revoluta*, *Ginkgo biloba*, *Podocarpus nagi*, *Keteleeria davidiana*, and *Pseudolarix kaempferi*. Electron micrographs illustrate the points made. [Cf. *F.A.* 21 No. 102.]

4044. YAMAZAKI, T., and TAKEOKA, M. **[Electron microscope investigations on the surface fine structure of the fossil pollen of *Cryptomeria japonica* detected from the peat.]** *Sci. Rep. Kyoto Prefect. Univ.* (*Agric.*) No. 11, 1959 (91–4 + 2 plates). 11 refs. [Jap.e.]

Describes optical and electron-microscope studies in which fossilized pollen found in alluvial peat at 1 m. depth was identified as *C. japonica* pollen by comparison with new pollen. Suggestions are made for extending the method to the identification of the pollens of other genera or species.

165.3/.7. Heredity, Genetics and Breeding; Variation

See also Nos. 4131, 4135, 4186, 4256, 4269–76, 4283–6, 4289–91, 4866, 4918, 4944.

4045. BIAŁOBOK, S. Wybrane zagadnienia z genetyki drzew. **[Selected problems of tree genetics.]** *Kosmos, Warszawa* (*Ser. A. Biology*) 8 (2), 1959 (133–49). 51 refs. [Pol.] L.S.

Reviews literature on forest tree breeding and genetics, with a brief historical outline from du Monceau (1760) and Beckmann (1770) to present-day work in Europe, Australia, Japan and the U.S.A.

4046. WRIGHT, J. W., and FINN, R. F. **A bibliography on forest genetics and forest tree improvement, 1956–1957.** *Misc. Publ. U.S. Dep. Agric.* No. 808, 1960. pp. 85.

Lists by author and subject > 1136 papers from world literature. [Cf. *F.A.* 18 No. 3711.]

4047. KING, J. R. **The freeze-drying of Pine pollen.** *Bull. Torrey Bot. Cl.* 86 (6), 1959 (383–6). 3 refs. O.B.D.

Preliminary tests on the freeze-drying of Loblolly Pine pollen showed that the pollen will retain a high % of its viability for long periods, even under uncontrolled conditions, following freeze-drying and storage in N gas. Germination was usually much higher after pollen had been kept in a household refrigerator (5° C. and 6% r.h.) for one or more days after release from N gas storage.

4048. DOBRINOV, I. Otnosno prorastvaneto na cvetnija prašec na belija bor (*P. silvestris* L.) v izkustvena sreda. **[The germination of *Pinus sylvestris* pollen in artificial media.]** *Nauč. Trud. Lesoteh. Inst., Sofija* No. 7, 1959 (21–33). 17 refs. [Bulg.g.]

The best medium was found to be a solution of 0·75% agar and 10% sucrose. Pure distilled water was also good. Cold storage over $CaCl_2$ resulted in reduced viability in the 6–7th and 10–11th months, with a corresponding increase in the 8–9th and 12th months of storage.

4049. MÜNZER, R. Untersuchung zur Physiologie von Pollenkeimung und Schlauchwachstum unter besonderer Berücksichtigung der Borsäurewirkung. **[The physiology of pollen germination and pollen-tube development, with special reference to the effect of H_3BO_3.]** *Biol. Zbl.* 79 (1), 1960 (59–84). 43 refs. [G.g.] E.M.B.

In > 60 angiosperms H_3BO_3 was found to have a stimulating influence on pollen-tube development, and (with a few exceptions) on pollen germination also. H_3BO_3 also stimulated pollen-tube development in some gymnosperms, among them *Taxus baccata*, *Thuja orientalis* and *Juniperus communis*. Germination was stimulated in pollen of *Larix decidua*, but pollen-tube development was not. No influence was found of H_3BO_3 on the nuclei of pollen tubes of *Pinus* spp. The reproductive organs of the gymnosperms contained a higher % of B than the other parts of the plant.

4050. KLAEHN, F. U., and NEU, R. L. **Hardwood pollen study.** *Silvae Genet.* 9 (2), 1960 (44–8). 16 refs. [E.e.g.f.]

Presents the results of a small-scale study with pollen of (1) *Ulmus americana*, (2) *Prunus serotina*, (3) *Populus tremuloides* and (4) *Betula papyrifera*. Brief morphological notes are given. In germination tests, using well known techniques, an agar medium with 10% sucrose proved highly satisfactory for (2) and (3). Poor results were obtained with (1) and (4). A positive correlation was found between speed of germination and pollen-tube length. *From authors' summary.*

4051. BODEN, R. W. **Handling and storage of pollen in *Eucalyptus* breeding.** *Aust. For.* 22 (2), 1958 (73–81 + 2 photos). 12 refs.

Germination of *Eucalyptus* pollen *in vitro* is successful, using 1·5% gelatine in 20% sucrose and incubating for 6 hours at 30° C. Variability in pollen germination, both within species and within a single tree, has been examined. Deep-freeze storage at −16° C. is successful, and field collection and transport are described. *Author's summary.*

4052. SCHELL, G. Keimschnelligkeit als Erbeigenschaft. **[The heritability of germinative energy.]** *Silvae Genet.* 9 (2), 1960 (48–53). 21 refs. [G.g.e.f.]

Seed of individual trees differs in germinative energy (g.e.) and this difference is of genetic origin, but in experiments with Spruce no correlation was found between g.e. and later growth rate. Assessment of this factor in parent trees, however, is valuable in that it is not advisable to use seed with a low g.e. in breeding trials; g.e. assessment may also be of economic interest. No relationship was established between 1000-seed weight and inherited g.e. *From author's summary.*

4053. **[The current position [March 1960] relating to the *Pinus radiata* tree improvement project initiated about 12 months earlier by the Forests Commission, Victoria.]** *For. tech. Pap. For. Comm. Vict.* No. 3, 1960. pp. 36 + 1 drawing, 1 map, 2 gphs. 34 refs.

Contains 9 papers: A review of forest tree improvement; *P. radiata* plus tree search in Victoria; Scion gardens and seed orchards (*K. J. Simpendorfer*); Propagation of plus trees; determination of the genotype (*L. A. Pederick*); Glasshouse (*C. J. Irvine*) [describing an aluminium-alloy frame and brick-base structure specially designed for precise r.h. control]; Should the glasshouse run east and west or north and south? (*A. Dresler*); Collection of scions by shooting (*H. J. Semmens*); *P. radiata* pollen dispersal trials (*H. J. Semmens*).

4054. Bingham, R. T., Squillace, A. E., and Wright, J. W. **Breeding blister rust resistant Western White Pine. II. First results of progeny tests including preliminary estimates of heritability and rate of improvement.** *Silvae Genet*. 9 (2), 1960 (33–41). 18 refs. [E.e.g.f.]

[Cf. *F.A.* 14 No. 3053.] Progeny tests were begun in 1952 with progenies of rust-resistant *Pinus strobus* phenotypes (61 controlled and 15 wind pollinations), along with 5 progenies from wind-pollinated normal, non-resistant types. In autumn 1957, when the trees were 6 years old, they were rated for the presence or absence of rust symptoms, and heritability of rust resistance was assessed. The results are presented. *From authors' summary*.

4055. Opyt i dostiženíja po selekcii lesnyh porod. **[Experiments and achievements in the selection and breeding of forest species.]** *Sborn. Rabot Lesn. Hoz. Vsesojuz. Nauč.-Issled. Inst. Lesovod*. No. 38, 1959. pp. 300. Many refs. [Russ.]

Six papers: Selection and breeding of *Phellodendron amurense* for industrial [cork] plantations (*R. F. Kudaševa*); Production of drought- and salt-resistant Poplars (*I. A. Kazarcev*) [by means of hybridization with Poplars of the subgenus *Turanga*]; Selection and breeding of Aspen in the forest-steppe zone for rapid growth, fungus resistance, and wood quality (*S. P. Ivannikov*); Selection of forms of *Pinus sylvestris* with a high resin yield (*E. P. Prokazin*) [cf. *F.A.* 20 No. 2806]; *Euonymus maackii* with a high gutta yield: selection, breeding and seed production (*N. E. Skripicyna*); Selection and breeding of *Acer* spp. in the Moscow region (*I. N. Zaikina*).

4056. Montserrat, P. Algunos aspectos de la diferenciación sistemática de los *Quercus* ibéricos. **[Some aspects of systematic differentiation in the Iberian species of Quercus.]** *Publicaciones del Instituto de Biología Aplicada, Barcelona* 26, 1957 (61–75). [Span.] L.S.

Oaks as relicts (the term "relict" including the persistence of some characters in populations of hybrid origin) are good indicators of climatic history, and the study of introgression in populations is valuable in determining former distributions. On these bases notes are presented on the past and present distribution of the Iberian Oak species, and a series of maps is given showing their actual distribution and maximum likely expansion during the Quaternary era.

4057. Hadfield, M. **Random notes on British Oaks.** *Quart. J. For*. 54 (2), 1960 (141–5). 11 refs.

[Cf. *F.A.* 21 No. 203.] Attempts to differentiate broadly between *Quercus robur* and *Q. sessiliflora*, and to define hybridity. The great variation in leaf-blade size and shape within one population is discussed, and it is concluded that hybrids are extremely rare, but that Cut-leaved Oaks and Cypress Oaks, usually described under *Q. robur*, are in fact of hybrid origin.

4058. Šutjaev, A. M. K anatomičeskoj harakteristike list'ev rannej i pozdnej form duba v geografičeskih kul'turah. **[Anatomical features of the leaves of early- and late-flushing forms of Quercus robur in provenance trial plots.]** *Bot. Ž*. 45 (2), 1960 (279–83). 9 refs. [Russ.]

Compares the number of stomata and total vein length per unit area of leaf surface. In most cases, no definite differences were found between leaves from early- and late-flushing forms. The fewer the stomata and the less the vein length, the more vigorous was growth in height, irrespective of phenological form.

4059. Silina, A. A. Transpiracija rano- i pozdnoraspuskajuščihsja ras duba v uslovijah lesostepi. **[Transpiration of early- and late-flushing races of Oak in the forest-steppe zone.]** *Trud. Inst. Les*. No. 41, 1958 (104–10). 12 refs. [Russ.]

Tabulates and graphs data on the amounts and rates of transpiration by *Quercus robur* vars. *praecox* and *tardiflora* in the Tellerman forest, from measurements made in 1954 and 1955. The transpiration rate of *tardiflora* was 31% greater than that of *praecox*, and its main water requirement comes in June/July, i.e. when there is little water in the soil. It is therefore recommended that the *praecox* variety be planted on elevated areas of the forest-steppe zone, despite its greater moisture requirement over the whole growing season, because it is better able to utilize for growth the autumn, winter and spring reserves of moisture in the soil.

4060. Larsen, C. M. L'amélioration du peuplier par voie génétique. **[Improvement of the Poplar by breeding.]** *Bull. Soc. For. Belg*. 67 (3; 4), 1960 (113–35; 149–72 + 26 photos). 9 refs. [F.]

A detailed account of methods employed and results obtained in Poplar breeding by the Institut de Populiculture, Union Alumettière, Grammont.

4061. Elorrieta y Artaza, J. Estudios de mejora de los chopos más interesantes para España. **[The improvement of Poplars of most interest to Spain.]** *Montes, Madrid* 16 (92), 1960 (115–31). [Span.]

Presents a short survey of the botanical and silvicultural characteristics of the genus, and gives a history of Poplar breeding in Spain, reviewing in some detail the work of the regional forest departments and of the Madrid Forest Research Institute.

4062. Meyer-Uhlenried, K. H. **Investigations of the transmission of an anatomical feature in crossings of Poplars of different sections.** *Transl. Commonw. Sci. Industr. Res. Organ. Aust*. No. 4227, 1960. pp. 19 + 2 gphs., 2 dgms., 1 photo. Transl. by J. Hardy from *Züchter* 28 (5), 1958 (209–16). [See *F.A.* 20 No. 1469.]

4063. Müller, R. Altstammsorten der Schwarzpappelbastarde (IIq.). Der Sortenfortschritt in der Pappelwirtschaft. **['Old stock varieties' of Black Poplar hybrids (IIq.). Better varieties for Poplar growers.]** *Holz-Zbl*. 86 (56) 1960 (791–2). [G.]

Briefly discusses the history of the 'old stock varieties', and others, including the results of selection and breeding. Since none of the old varieties is considered completely satisfactory, the author advocates systematic breeding on the scale practised in Italy. The object should be to produce clones superior in ease of propagation, growth, habit, disease resistance, etc., in early life; it is thought that this will ensure desirable properties, including wood properties, in the mature trees. Mention is made of recently bred columnar Poplars which resemble Lombardy Poplar but are not susceptible to *Dothichiza populea*.

4064. LI, S.-W. Primenenie mnogokratnogo opylenija v selekcii topolej. **[Repeated pollination in Poplar breeding.]** *Vestn. sel'.-hoz. Nauki* 5 (2), 1960 (140–3). 5 refs. [Russ.e.g.f.] O.W.

Flowers of *Populus nigra* var. *italica* ♀ (from Peking) were pollinated, under laboratory conditions, with pollen from *P.* × *berolinensis* from Harbin and Moscow by two methods: (*a*) pollinated 3 times at 12-hour intervals, and (*b*) pollinated once. Seeds from (*a*) were more numerous and of better quality than those from (*b*). Seedlings obtained from (*a*) were larger, and closer to the paternal form than those from (*b*). The Moscow parent gave more and bigger fruits and seeds, and more vigorous seedlings, than the Harbin parent. From the hybrids, eight new forms are distinguished and briefly described.

4065. LÊ, T.-Y. **[New achievements in producing faster-growing new hybrids through applying Mičurin's genetic principles.]** *For. Sci., Peking* 1959 (3), (259–60). [Chin.]

Brief notes on the following hybrids produced by the author: (1) *Populus cathayana* × *P. pyramidalis* = *P. pekinensis*, which showed strong characteristics of the mother tree, *P. pyramidalis*; (2) *P. pyramidalis* ♂ × *P. simonii* = *P. opera*, whose height increment was greater than the ♂ and ♀ parents' by 76 and 30% respectively, (3) *P. yunnanensis* ♂ × *P. simonii* = *P. velox*, whose height increment was 99% greater than that of *P. simonii* and 363% greater than that of *P. pyramidalis*. The author also reports the successful hybridization of *Salix matsudana* and *P. pyramidalis* by Professor Hsü, after smearing the sap from the stigma of the latter on the stigma of the former and then transferring pollen from the latter. Seed of the F_1 generation was successfully germinated.

4066. ORLENKO, E. Wartościowa forma osiki rosnącej w lasach Białorusi. **[A valuable form of Aspen growing in Belorussia.]** *Sylwan* 104 (1), 1960 (15–9). 7 refs. [Pol.]

Distinguishes light-, grey-, green- and dark-barked forms of *Populus tremula*, the grey-barked form being commonest. The superior green-barked form is described, and brief notes are given on its height and diameter growth, wood properties, propagation, etc.

4067. SCHÖNBACH, H. Einige Ergebnisse achtjähriger Züchtungsversuche mit Pappelarten der Sektion *Leuce*. **[Some results of eight-year-old breeding trials with Poplar varieties of the section *Leuce*].** *Wiss. Abh. Dtsch. Akad. LandwWiss., Berl.* No. 44 (*Beitr. Pappelforsch.* No. 4), 1960 (7–21). 3 refs. [G. g.russ.e.]

[Cf. *F.A.* 19 No. 1399.] Reports on breeding trials with *Populus tremula* started 8 years ago or later at Graupa and Rabenau (Saxony). Crossing local races of poor stem form and habit with N. or N.E. European provenances improved form but shortened the growing season and slowed down growth rates. Some crosses of local parents, however, produced good stem form and rate of growth, a result not predictable from the parental phenotype. Crosses with *P. alba* resulted in short stems with branchy crowns, and crosses with *P. tremuloides* in many deformed (bushy) individuals.

4068. JANSON, L. Analiza przyrostu siewek mieszańców topoli. **[Analysis of growth of hybrid Poplar seedlings.]** *Sylwan* 104 (1), 1960 (77–89). [Pol.russ.e.]

Statistical analyses were made, mainly with hybrid 243 (*Populus tremula* × *P. tremuloides*). It was found that site fertility directly influenced height growth and branching. Selection was impossible among 1-year-old seedlings, but could be done with considerable accuracy after the second growing season, using height and degree of branching as the basic criteria. These were also used to construct a key to classify the growth of 2-year-old seedlings in order to predict their height growth in the following year.

4069. **Hybrid Poplar growth rates correlated with root anatomy.** *Extr.* from *Rep. Ntheast. For. Exp. Sta. 1959*, 1960 (18).

A study of the root anatomy of hybrid Poplars has revealed a relationship between root anatomy and vigour. Roots of trees of 25 clones [not specified], 1 year old from cuttings, were used. Although many features of root anatomy were investigated, bark thickness (on roots of similar diameter) appears to be the best single criterion for selection. Fast-growing clones are characterized by thin bark, whereas slower-growing types have thicker bark. Highly significant correlations were obtained between the root bark % of the 1-year-old trees and the height and diameter growth of the same clones in 9-year-old plantations.

4070. WETTSTEIN-WESTERSHEIM, W. Trockensubstanzuntersuchung als Methode der Selektion umweltangepasster Weiden. **[Dry-matter content as a criterion for the selection of Willows adapted to particular sites.]** *Allg. Forstztg.* 71 (11/12), 1960: *Suppl.* (*Informationsdienst* No. 33). p. 2. [G.]

Marked differences in autumn dry-matter content, indicative of the degree of lignification, were found between one-year-old shoots of 40 clones of tree and osier Willows. Some clones gave higher values in the drier climate of Tulln (Lower Austria), others in the more humid Gmunden, and some were equally adapted to both sites. Clone 1, *Salix purpurea* × *S. repens*, topped the list in both places for both early and late growth.

4071. FOSBERG, F. R. **Introgression in *Artocarpus* (Moraceae) in Micronesia.** *Brittonia, N.Y.* 12 (2), 1960 (101–13). 21 refs.

Discusses the nomenclature and taxonomy of

Artocarpus spp. in the region with chief reference to *A. altilis* and *A. mariannensis* (united by Jarrett under *A. communis* (*A. incisus*)), and briefly describes variants and intergrades interpreted as resulting from introgression. A comprehensive long-term study of variation in the Breadfruit throughout the Pacific area is to be made by Dr. J. Barrau, of the S. Pacific Commission, Noumea.

4072. JACKSON, W. D. **Natural hybrids in Eucalypts, Part I. *E.* × *taeniola* (= *E. salicifolia* × *E. sieberiana*.)** *Papers and Proceedings of the Royal Society of Tasmania, Hobart* 92, 1958 (141–6). 4 refs. L.S.

Progeny tests with open-pollinated seeds from *Eucalyptus sieberiana*, *E. salicifolia* and *E.* × *taeniola* showed that the juvenile leaves of the last named were transitional in size and shape between the two former, confirming the view that it is a natural hybrid between them. *From author's summary.*

4073. MELVILLE, R. **A metrical study of leaf-shape in hybrids: I. The leaf-shape of some F_1 hybrids and their parents.** *Kew Bull.* 14 (1), 1960 (88–102). 7 refs.

Examines, in examples from four genera, the proposition that the leaf shapes of hybrids are intermediate between those of their parents. No exact intermediates were found in which hybrid interaction was uncomplicated with some other phenomenon. The simplest type of interaction was an intergrading of characters along the leaf axis, one parent being partially dominant towards the leaf base, and the other towards the apex, as in *Prunus* × *fontanesiana*. Parental effects were equally balanced in *Rhododendron orbiculare* × *R. williamsianum*, but there was positive heterosis on the character of relative leaf breadth. In *Ribes* × *gordonianum* axial intergrading was complicated by negative heterosis on the lengths of the large basal lobes and positive heterosis on the breadths of the subterminal lobes. *Forsythia* × *intermedia* was found to have a leaf shape exactly intermediate between the leaves of the simple-leaved parent and the terminal leaflets of the other parent, which has both simple and trifoliolate leaves. The concepts of positive and negative heterosis are discussed.

4074. RAO, H. S. **Colchicine-induced variants in Bamboo improvement.** *Indian For.* 86 (3), 1960 (132–8). 6 refs.

A preliminary test in 1953 with 3 colchicine-treated seedlings (*Dendrocalamus strictus*) suggested an extended trial in the following year, when 37 treated plants and 7 controls were prepared for field trial. In 1956, two-year-old plants revealed interesting characters associated with polyploidy, namely, increased vigour, production of thicker or wider leaves, and larger but fewer tuberculate hairs on the dorsal leaf-surface. Frequency tables compiled from data on vigour, leaf thickness and number of hairs showed that in about 12 out of the 37 treated plants there was a definite increase in vigour, leaf thickness and leaf width associated with increased size of hairs, the last effect resulting in fewer hairs per unit area. These easily observed criteria for early evaluation of artificial polyploids or mutants are of great interest and value to breeders of forest species. *From author's summary.*

4075. SAX, K. **Meiosis in interspecific Pine hybrids.** *For. Sci.* 6 (2), 1960 (135–8). 10 refs.

Cytological studies of F_1 hybrids between *Pinus griffithii* and *P. strobus*, *P. parviflora* and *P. strobus*, and *P. holfordiana* and *P. parviflora*, show that meiosis is nearly normal. The hybrids are vigorous, and fertility relatively high. Although geographically separated for very long periods, these Himalayan, Japanese and American species of White Pine appear to be similar in chromosome constitution and genetic compatibility. *From author's summary.*

4076. CHAMBERS, K. L. **On the origin of an unusual *Dipholis* from the Florida Keys.** *Trop. Woods* No. 112, 1960 (40–57 + 2 plates). 15 refs.

[Cf. *F.A.* 19 No. 2229.] In 1958 an aberrant tree of *D. salicifolia* was discovered on the island of No Name Key, Florida, which differed from surrounding individuals in having wider leaves, larger flower clusters, and larger flowers. Although its leaf shape fell within the variation range of the species as a whole, leaf width was extreme among specimens from the Florida Keys. The larger floral parts of the aberrant tree had longer cells than normal plants, and guard cells on its leaves were significantly longer than on samples from 5 other collections. The chromosome number of normal *D. salicifolia*, determined from meiotic second anaphase, is $n = 12$. Tapetal cells of the aberrant individual showed $2n = 36$ at mitotic prophase. Meiosis was irregular, and micronuclei were common at first and second telephases. Chromatin bridges and fragments were rare. Small supernumerary spores were seen in 41% of microspore quartets. The aberrant tree was estimated to have a fertility, as measured by fruit set, of slightly < 10% of that of adjacent trees and its origin through spontaneous autotriploidy is suggested. *From author's summary.*

4077. IRWIN, H. S., and TURNER, B. L. **Chromosomal relationships and taxonomic considerations in the genus *Cassia*.** *Amer. J. Bot.* 47 (4), 1960 (309–18). 25 refs. O.B.D.

Presents a table giving all known chromosome numbers for the genus *Cassia*. There is evidence that the basic number for the genus is 7, the other numbers having been derived by aneuploid loss from various euploid levels. The results of the present study do not support elevation of the section *Chamaecrista* to generic rank. *From authors' summary.*

4078. SUDA, Y. **Chromosome numbers of Japanese Salicaceae. I, II.** *Science Reports of the Tohoku University, Sendai* (*Ser. 4, Biology*) 24 (1), 1958 (1–4); 25 (1), 1959 (13–9). 20 refs. [E.] L.S.

4079. SARVAS, R. Kaksi triploidista haapaa ja koivua. **[Two triploid Aspens and two triploid Birches.]** *Commun. Inst. For. Fenn.* 49 (7), 1958 (1959). pp. 25. 21 refs. [Fi.*e.e.*]

An account of the growth characteristics and chromosome complement of two *Populus tremula* clones and two specimens of *Betula verrucosa*, the only triploid trees of these species so far discovered in Finland.

168. Histology

See also Nos. 4851 *et seq.*, 4937.

4080. RICHARDSON, F. **A method of examining fossilized or semi-fossilized plant tissues impregnated with calcareous substances.** *Kew Bull.* 14 (1), 1960 (87).

Describes experiments with semi-fossilized leaf material, involving treatment with dilute HCl (a suitable concentration must be found by trial) to detach the plant tissue from the calcareous matter, floating the tissue on to a slide (great care is necessary; a smear of egg albumen on the slide helps to make the material adhere), and irrigating with water to remove the acid.

17. Systematic Botany

172.3. Schizophyta (Bacteria and Blue-green Algae)

4081. PETERSON, J. E. **New species of myxobacteria from the bark of living trees.** *Mycologia* 51 (2), 1959 (163–72). 5 refs. O.R.S.

Describes 4 species, 3 from *Ulmus americana* and other trees in Missouri, and 1 from *Cupressus sempervirens* at Olympia, Elis, Greece.

172.8. Eumycetes (True Fungi)

See also Nos. 4551 *et seq.*, 5048 *et seq.*

4082. CALLAHAM, R. Z., and SHIFRINE, M. **The yeasts associated with bark beetles.** *For. Sci.* 6 (2), 1960 (146–54). 30 refs.

A review with the main aims of: (1) bringing together many scattered and inaccessible references on the yeasts; (2) providing additional information on a recent paper on yeast taxonomy [see *F.A.* 17 No. 3068]; and (3) presenting data on the growth at several temperatures of some yeasts associated with barkbeetles.

4083. BATRA, L. R. **A comparative morphological and physiological study of the species of *Dipodascus*.** *Mycologia* 51 (3), 1959 (329–55). 53 refs. O.R.S.

Includes an account of the life history of *Dipodascus aggregatus*, which has been found in Sweden in galleries of *Ips acuminatus* in *Pinus sylvestris*, and in America in frass in *Ips pini* galleries in *P. resinosa* roots, and in ambrosia beetle frass in *Picea engelmannii*. [Cf. *F.A.* 14 No. 511.]

4084. KENNEDY, L. L. **The genera of the Dacrymycetaceae.** *Mycologia* 50 (6), 1958 (874–95). 36 refs. O.R.S.

Following a comprehensive survey of literature and collections, 9 genera are recognized, and a key is given for their identification.

4085. KENNEDY, L. L. **The genus *Dacrymyces*.** *Mycologia* 50 (6), 1958 (896–915). 17 refs. O.R.S.

Presents a key, with full descriptions, of the 12 species attributed by the author to this genus. All were found on the bark or exposed wood of seed plants, and appear to be non-specific.

4086. MARTIN, G. W. **A new species of *Dacrymyces* from Honduras.** *Mycologia* 50 (6), 1958 (939–41). O.R.S.

D. dictyosporus sp. nov. was found growing on the bark of *Pinus oocarpa* at an altitude of 4500 ft. at Mt. Uruyu, Zamorado. A full description is given.

4087. SINGER, R. **New and interesting species of Basidiomycetes VII.** *Mycologia* 51 (4), 1959 (578–94). O.R.S.

Deals with 13 species from different continents. Tree associations are noted where applicable.

4088. WELLS, K. **Studies of some Tremellaceae III. The genus *Bourdotia*.** *Mycologia* 51 (4), 1959 (541–63). 23 refs. O.R.S.

Recognises 11 species, most of which are lignicolous.

4089. SNELL, W. H., SINGER, R., and DICK, E. A. **Notes on Boletes. XI.** *Mycologia* 51 (4), 1959 (564–77). O.R.S.

Contains a list of a collection made in Michigan in 1953, and redescriptions or descriptions of 6 *Suillus* spp., 2 *Leccinum* spp., *Xerocomus truncatus* sp. nov., and *Boletellus zelleri* comb. nov., with notes on their tree associations.

4090. CUMMINS, G. B. **Illustrated genera of rust fungi.** Burgess Publishing Co., Minneapolis, Minn. 1959. pp. ii + 131 + 1 plate. 54 refs. Price 36*s*.

Presents keys, descriptions and illustrations of the genera (95) of rust fungi of the world, arranged systematically, with an introduction on forms, biology, life cycles, host relationships etc. and a glossary.

4091. LEPPIK, E. E. **Some viewpoints on the phylogeny of rust fungi. III. Origin of grass rusts.** *Mycologia* 51 (4), 1959 (512–27). 34 refs. O.R.S.

Presents a theory that the early ancestors of the Pucciniae descended from the ancestral Gymnosporangiae, whose rusts in their turn evolved from the ancient Melampsoraceae. Beginning from an ancient stock of aecioid conifer rusts, these parasites moved first from the Abietaceae to the Cupressaceae, changing from conifer forests to the *Cupressus*/angiosperm vegetation. In the new environment the fungi moved again from the Cupressaceae to the arboreous angiosperms, then to grasses and rushes, and finally to the higher angiosperms. Their expansion presumably began from the early Mesozoic conifer forests of the northern hemisphere, continued through the mixed forests of the Cretaceous period, and terminated in world-wide grassland areas. *From author's summary.*

4092. CUTTER, V. M. **Studies on the isolation and growth of plant rusts in host tissue cultures and upon synthetic media. I. *Gymnosporangium*.** *Mycologia* 51 (2), 1959 (248–95). 49 refs. O.R.S.

Tissue and synthetic cultures were successfully established from the telial galls of *G. juniperi-virginianae* produced on *Juniperus virginiana*. After several years, all strains isolated proved capable of reinfecting their alternate hosts (*Crataegus* spp.), and some were also capable of infecting *J. virginiana*.

174. Spermatophyta, Seed-Plants in General. Floras and Check-Lists

4093. AUSTIN, T., and MOEN, H. Trær og busker i farger. **[Trees and shrubs in colour.]** H. Aschehoug & Co. (W. Nygaard), Oslo. 1960. pp. viii + 198. [Nor.] I.F.B.

Covers 120 species, 56 of which occur naturally in Norway. The coloured plates show, as applicable, twigs, leaves, flowers, fruit, habit of growth, pests and uses. The descriptions include notes on distribution, a description of the tree or shrub with characteristics for identification, a description of the wood, uses of the wood and other parts of the plant, and notes on silvicultural requirements, pests and diseases (with particular reference to Norway and the other Scandinavian countries), and on forms and varieties. There are keys to species, and indexes to Latin and Norwegian names.

4094. AUBRÉVILLE, A. La flore forestière de la Côte d'Ivoire. Tomes I–III. **[The forest flora of the Ivory Coast. Vols. I–III.]** *Publ. Centre Tech. For. Trop.* No. 15 (2nd ed. rev.) 1959. pp. 369 + 341 + 334. 16 refs. [F.]

A new edition, considerably revised and expanded, of a work first published in 1936.

4095. Flore du Congo Belge et du Ruanda-Urundi. Spermatophytes. Vol. IX. **[Flora of the Belgian Congo and of Ruanda-Urundi. Spermatophytes. Vol. IX.]** Institut National pour l'Étude Agronomique du Congo Belge (I.N.É.A.C.), Brussels. 1960. pp. 597 + 1 map. [F.]

Buxaceae, Anacardiaceae, Aquifoliaceae, Celastraceae, Hippocrateaceae, Salvadoraceae, Icacinaceae, Sapindaceae, Melianthaceae, Balsaminaceae, Rhamnaceae, Vitaceae, Leeaceae. [Cf. *F.A.* 19 No. 3869.]

4096. HUBBARD, C. E., and MILNE-REDHEAD, E. [Editors.] **Flora of tropical East Africa. Loganiaceae.** Crown Agents for Overseas Governments and Administrations, London. 1960. pp. 47. Price 4*s*.

Loganiaceae (including Buddleiaceae).

4097. MACBRIDE, J. F. **Flora of Peru.** *Botanical Series, Field Museum of Natural History, Chicago* 13 (Part 5, No. 1), 1959. pp. 536 + ii.

Haloragaceae to Convolvulaceae. [Cf. *F.A.* 18 No. 2522.]

4098. FLOYD, A. G. **Field identification of seedlings of the major tree species in the Blackbutt and Flooded Gum areas.** *Res. Note Div. For. Mgmt. For. Comm. N.S.W.* No. 1, 1958. pp. 10.

Two dichotomous field keys are provided for the identification at different stages of seedlings of the 10 major tree species in the Blackbutt (*Eucalyptus pilularis*) and Flooded Gum (*E. grandis*) forest types. Seedlings of 1–12 months can be identified. The characteristic features of the 10 species are also listed. *From author's summary.*

174.2/7. Gymnosperms

See also No. 4075.

4099. FLORIN, R. **Notes on the systematics of the Podocarpaceae.** *Acta Horti Bergiani, Uppsala* 17 (11), 1958 (403–11). 42 refs. [E.] L.S.

A review of the position, discussing morphology and anatomy of foliage, wood, and reproductive organs, the development of the gametophytes and embryos, cytology, chemistry, and palaeobotany. The Podocarpaceae are compared with the Cephalotaxaceae and Taxaceae.

4100. GAUSSEN, H. Les gymnospermes actuelles et fossiles. **[Extant and fossil gymnosperms.] Fasc. VI. Coniferales Pt. 3: Pinoïdenes. 1. Abietaceae.** *Trav. Lab. For. Toulouse* 2, I (6), 1960. pp. 272. [F.]

This fascicle contains a general account of the Abietaceae with a table of genera, followed by a detailed account of the genus *Pinus* (extant forms fossil forms, natural classification, importance for forestry). [Cf. *F.A.* 17 No. 2499.]

4101. **[Bibliography on] utilisation of *Pinus radiata* Supplement No. 1, references 1948–59.** *Bibliogr. Ser. For. Prod. Aust.* No. 33*A*, 1960. pp. 39. 371 refs.

[Cf. *F.A.* 12 No. 1997.] A classified (and partly annotated) bibliography, covering world literature, with sections on: general properties; botanical characters and wood structure; growth; chemistry; pulping; resin tapping; physical and mechanical properties; diseases and pests; natural durability and preservative treatment; seasoning; plywood, veneer and gluing; finishing; grading, utilization; disposal and use of wood waste.

176.1. Dicotyledons

See also Nos. 4037, 4041, 4056–8, 4071–3, 4076–9, 4131, 4855–7.

4102. MARAIS, W. **An enumeration of the *Maytenus* species of southern Africa.** *Bothalia* 7 (2), 1960 (381–6). Many refs.

Enumerates 15 species, with a key. In the author's opinion, *Gymnosporia* cannot be maintained as a distinct genus, and several new combinations are made for species transferred from *Gymnosporia* to *Maytenus*.

4103. HU, S.-Y. **A revision of the genus *Clethra* in China.** *J. Arnold Arbor.* 41 (2), 1960 (164–90).

History of studies on the genus, taxonomic characters, ecological notes and geographical distribution, and key to the sections, series and species.

4104. WINTER, B. de. **Notes on some South African species of the genus *Euclea*.** *Bothalia* 7 (2), 1960 (403–5). Several refs.

E. lanceolata is reduced to a synonym of *E. crispa* var. *crispa*; *E. ovata* becomes *E. c.* var. *ovata* comb. et stat. nov. (with discussion of its possible origin through hybridization between *E. c.* and *E. coriacea*). *E. macrophylla* is a synonym of *E. schimperi* var. *schimperi*; *E. daphnoides* becomes *E. s.* var. *daphnoides* stat. nov.

4105. LÉONARD, J. Notulae systematicae XXVII. Notes sur diverses Euphorbiacées africaines des genres *Bridelia*, *Croton*, *Grossera*, *Maprounea* et *Tetrorchidium*. **[Notulae systematicae XXVII. Notes on various African Euphorbiaceae of the genera *Bridelia*, *Croton*, *Grossera*, *Maprounea* and *Tetrorchidium*.]** *Bull. Jard. Bot. Brux.* 29 (3), 1959 (195–203). [F.] O.B.D.

4106. BRENAN, J. P. M., and MELVILLE, R. **The Latin name of the Black Wattle.** *Kew Bull.* 14 (1), 1960 (37–9 + 2 plates). Several refs.

If Black Wattle is regarded as a variety of *Acacia decurrens*, its correct name is *A.d.* var. *mollis*, but the abundant material at Kew emphatically supports the opinion that it is a distinct species. The specific name *A. mollissima*, however, is shown to refer to *A. pubescens*, under which it is reduced to synonymy. The only available specific name for Black Wattle appears to be *A. mearnsii* De Wild. This last was allegedly a new species endemic to E. Africa: the two specimens cited by the author, both from Kenya, are in fact (*a*) Black Wattle and (*b*) *A. dealbata*, but his description is predominantly based on (*a*), which is proposed as the lectotype. It is concluded, reluctantly, that as a species the Black Wattle must be called *A. mearnsii*.

4107. FASBENDER, M. V. **Pollen grain morphology and its taxonomic significance in the Amherstieae, Cynometreae, and Sclerolobieae (Caesalpiniaceae) with special reference to American genera.** *Lloydia* 22 (2), 1959. pp. 162. 42 refs. P.R.

4108. SCHLÄTZER, G. Sibiriske ærter, en gammelkendt, kommende nytteplante. **[*Caragana arborescens*, a long-known and promising economic plant.]** *Dansk Skovforen. Tidsskr.* 45 (5), 1960 (189–218). 35 refs. [Dan.]

Summarizes its history and uses in Denmark, presents data from Denmark and from elsewhere on its soil requirements and resistance to frost, drought, wind, insects and fungi, and to browsing, and discusses its seed and sowing, and the selection and breeding of strains with good wind resistance and of suitable habit for hedges.

4109. LAMB, F. B. **A selected, annotated bibliography on Mahogany.** *Carib. For.* 20 (1/2), 1959 (17–37). [E.span.]

Presents a selected list of 240 works from world sources, dating from 1754 to the present day, grouped under some main headings of the O.D.C., and with an author index.

4110. JARRETT, F. M. **Studies in *Artocarpus* and allied genera, IV. A revision of *Artocarpus* subgenus *Pseudojaca* (concluded).** *J. Arnold Arbor.* 41 (2), 1960 (111–40).

[Cf. *F.A.* 21 No. 1505.] Describes 10 species and 5 subspecies to conclude the revision of the subgenus, and lists *species excludendae*, *nomina dubia* and *nomina nuda* for the genus.

4111. GARDNER, C. A. **Trees of Western Australia. No. 39—Comet Vale Mallee; No. 40—the Woodline Mallee; No. 41—the Ribbon-barked Mallee; No. 42—the Burracoppin Mallee; No. 43—the Cap-fruited Mallee; No. 44—the Spearwood Mallee; No. 45—the Apple Mallee; No. 46—the Goblet Mallee.** *Repr.* from *Journal of Agriculture of Western Australia, Perth* (*Ser. 4*) 1 (2), 1960 (100–11).

Brief notes (description, distribution) on *Eucalyptus comitae-vallis*, *E. cylindrocarpa*, *E. sheathiana*, *E. burracoppinensis*, *E. dielsii*, *E. doratoxylon*, *E. buprestium*, and *E. scyphocalyx*.

4112. GARDNER, C. A. **Trees of Western Australia. Eight *Eucalyptus* trees from the tropical north.** *Journal of Agriculture of Western Australia, Perth* (*Ser. 4*) 1 (3), 1960 (212–22).

Short notes on description and distribution of *E. polycarpa*, *E. terminalis*, *E. argillacea*, *E. lirata*, *E. mooreana*, *E. oligantha*, *E. brachyandra*, and *E. dichromophloia*.

4113. HOWARD, R. A. **Studies in the genus *Coccoloba*, IX. A critique of the South American species.** *J. Arnold Arbor.* 41 (2), 1960 (213–29).

[Cf. *F.A.* 21 No. 2809.] Brings together all records of taxa of *Coccoloba* for S. America, corrects errors in literature citation, evaluates and compares published species (where possible), locates existing type collections, and selects lectotypes of many species. This part of the work covers 32 species.

4114. GIORDANO, E. Il *Populus deltoides* Bartr. nel suo paese di origine. Nota preliminare su un viaggio di studio. **[*P. deltoides* in its native habitat. Preliminary note on a study tour.]** *Pubbl. Cent. Sper. Agric. For., Roma* No. 3, 1959 (1960), (127–80 + 19 plates). 55 refs. [It.it.e.*e*.]

Notes on a tour made by the author in the U.S.A. in 1958, giving particular attention to natural stands of *P. deltoides* in the lower Mississippi, Louisiana, Arkansas, and Illinois. Visits were also made to stands of natural hybrids of *P. alba* × *P. grandidentata* and plantations of artificial hybrids.

4115. MEEUSE, A. D. J. **Notes on the Sapotaceae of southern Africa.** *Bothalia* 7 (2), 1960 (317–79). Many refs.

A taxonomic revision, with keys to genera and species and a table of distinctions between *Mimusops*, *Austromimusops* gen. nov., *Baillonella* and *Manilkara*. The genera here recognized are *Sideroxylon* (1 sp.), *Chrysophyllum* (2), *Pouteria* (3), *Vincentella* (1), *Lecomtedoxa* (1), *Austromimusops* (3), *Mimusops* (3), *Manilkara* (4) and *Muriea* (1).

4116. HU, S.-Y. **A monograph of the genus *Paulownia*.** *Quart. J. Taiwan Mus.* 12 (1/2), 1959 (1–54 + 7 sets of drawings). [E.]

Covers history, introduction and cultivation (dealing mainly with countries outside Asia), morphological peculiarities and taxonomic characteristics, life history and embryology, physical properties and anatomy of the wood, ecology and distribution, uses, etc., and gives keys to sections and species and describes 6 species.

18. Plant Ecology

181. Mode of Life, Autecology. Silvicultural Characters of Trees

See also Nos. 4108, 4114, 4116, 4849, 5228.

4117. Switzer, A. L. K.; Sonley, G. R.; Leblanc, H. **Jack Pine.** *Woodl. Sect. Index Canad. Pulp Pap. Ass.* No. 1911 (*F*-2), 1959. pp. 5.

Three short papers covering distribution, characteristics, value, and problems associated with silviculture and management.

4118. Nelson, T. C. **Silvical characteristics of Bitternut Hickory (*Carya cordiformis* (Wangenh.) K. Koch).** *Sta. Pap. Stheast. For. Exp. Sta.* No. 111, 1960. pp. 9. 20 refs.

4119. Lotti, T. **Silvical characteristics of Swamp Chestnut Oak (*Quercus michauxii* Nutt.).** *Sta. Pap. Stheast. For. Exp. Sta.* No. 110, 1960. pp. 8.

4120. Zeller, W. Sobre la significación ecológica de la presencia de *Quercus suber* L. en Cataluña. **[The ecological significance of the presence of *Q. suber* in Catalonia.]** *Publicaciones del Instituto de Biología Aplicada, Barcelona* 26, 1957 (87–94). 15 refs. [Span.] L.S.

Reviews climatic, edaphic, topographical and biotic influences in Catalonia in connexion with the silvicultural characters and distribution of *Q. suber*. In only a limited area of Catalonia are climate and soil very favourable. Contrary to its behaviour in its principal growth regions, the tree is not found in areas of high rainfall, probably because of the accompanying low temperature. This fact, and its low altitudinal range and preference for sunny sites, show that it is here at its northern limit. In Catalonia *Q. suber* is in intense competition with *Q. ilex*. Although in the unstripped state it is more fire-resistant, any precedence over *Q. ilex* is normally due to human intervention.

4121. Rispoli, E. L'ontano sostituisce il castagno nella penisola Sorrentina. **[Alder replaces Sweet Chestnut in the peninsula of Sorrento.]** *Ital. for. mont.* 15 (2), 1960 (73–80). 1 ref. [It.f.]

Describes the natural invasion of diseased *Castanea sativa* coppice by Alder [*Alnus glutinosa*?], and presents data from analyses of soils under Chestnut and under Alder, demonstrating the beneficial effects of the latter. The rapid growth of this species is another reason for encouraging it, and suggestions are made for managing the natural stands as high forest.

4122. Starikov, G. F. Cennaja poroda severa. **[*Populus suaveolens*—a valuable species in the north of the U.S.S.R.]** *Priroda, Moskva* 49 (4), 1960 (104–5). [Russ.] A.P.B.

A brief general account covering, *inter alia*, distribution, stand volume, and height.

4123. Essências florestais da Guiné Portuguesa. 11–16. **[Forest species of Portuguese Guinea. 11–16.]** Jardim e Museu Agrícola do Ultramar, Ministério do Ultramar, Lisbon. 1959. [Port.e.f.]

[Cf. *F.A.* 20 No. 1507.] (11) *Schrebera arborea* (pp. 13 + 4 plates); (12) *Cola cordifolia* (pp. 13 + 4 plates); (13) *Parinari excelsa* (pp. 13 + 4 plates); (14) *Lophira lanceolata* (pp. 13 + 3 plates); (15) *Dialium guineense* (pp. 13 + 4 plates); (16) *Borassus aethiopum* (pp. 15 + 3 plates).

4124. Seabra, L. de, and Ferreirinha, M. P. *Terminalia superba* Engl. & Diels (Limba), ficha tecnológica e florestal. **[*T. superba* (Limba)—technological and silvicultural notes.]** *Garcia de Orta, Lisboa* 7 (3), 1959 (509–31 + 8 photos). 14 refs. [Port.f.e.]

Presents data on the characteristics of the species, nomenclature, distribution, silvicultural characters, methods of artificial regeneration used in the French Congo, and the anatomy of the timber and its chemical characteristics, with results of investigations made by the wood technology laboratory of the Junta de Investigações do Ultramar and an evaluation of its use as a raw material for pulp. Published data (French, Portuguese and FAO) on physical and mechanical properties of the wood, seasoning, preservation and world markets are also reviewed.

4125. *Cassia* spp. Caractères sylvicoles et méthodes de plantation. **[Silvicultural characters of *Cassia* spp. and plantation techniques.]** *Bois For. Trop.* No. 70, 1960 (43–8). 10 refs. [F.]

Deals with *Cassia siamea*, *C. fistula*, *C. auriculata*, *C. spectabilis*, *C. nodosa*, *C. javanica* and *C. timoriensis*, some of which are now being planted experimentally in Africa, while *C. siamea* is already widely used there.

181.1. Distribution, Natural Range

See also No. 4056.

4126. Liu, Y.-P., Chiang, C.-P., and Chang, Y.-H. **[The growth and distribution of *Cunninghamia lanceolata* and *Pinus massoniana* in Honan province.]** *For. Sci., Peking* 1960 (1), (24–43). [Chin.e.]

Determines the horizontal and vertical distribution of the two species in the province, especially in the Funiu Shan, Tungpai Shan and Tapieh Shan. At ca. 40 years, *C. lanceolata* attains heights of 14 m., d.b.h. 25 cm., and volume of 0·35 cu. m.; at 30–40 years, values for *P. massoniana* are 10–17 m., 12–32 cm., and 0·066–0·662 cu. m. respectively. The best sites for both species in Honan are lower and middle slopes, sheltered from the wind, with deep, fertile, well drained soil. Given these conditions, it would not be impracticable to extend the area of planting to the N. side of the Funiu Shan, the Taihang Shan [S. Shansi], and the plain of E. Honan, especially with *C. lanceolata*.

4127. Güde, J. Der historische Fichtenvorstoss in das oberösterreichische Alpenvorland. **[The**

immigration of Spruce in historical times in the prealpine regions of Upper Austria.] *Cbl. ges. Forstw.* 77 (1), 1960 (1–18). 30 refs. [G.g.]

A study of historical records at the Lambach monastery indicates that the forests in the region were broadleaved in the 11th century. Spruce invaded them naturally in the 16th and became dominant in former Oak forest in the 18th century, as a consequence of soil degradation through forest grazing, litter removal etc. and also climatic changes. Spruce was not sown before the beginning or planted before the middle of the 19th century.

4128. Somora, J. O rozšírení borovice limby—*Pinus cembra* L. a tisu obyčajného—*Taxus baccata* L. v Belanských Tatrách. **[Distribution of *P. cembra* and *T. baccata* in the Belanské Tatry Mts.]** *Sborn. Prác Tatr. Nár. Parku, Tatr. Lomnica* No. 3, 1959 (85–126 + 1 map). 95 refs. [Slovak.russ. e.g.] [Cf. *F.A.* 20 No. 4247.]

4129. Bethune, J. E. **Distribution of Slash Pine as related to certain climatic factors.** *For. Sci.* 6 (1), 1960 (11–7). 11 refs.

The relationship of climatic variables to the natural distribution of *Pinus elliottii* in the U.S.A. was studied. The variables used were monthly means of temperature and rainfall by seasons, and mean length of frost-free periods, for 23 stations within the range of natural distribution and 27 stations outside, but adjacent. The data were analysed by the discriminant function method and the following variables, listed in the order selected, were found to be significant in discriminating between the two regions: mean monthly frequency of rain (*a*) ⩾ 0·5 in. in summer, (*b*) ⩾ 0·5 in. in spring, (*c*) ⩾ 0·5 in. in winter, (*d*) ⩾ 0·01 in. in autumn. Further study is necessary to determine how these climatic differences may operate to affect the occurrence of the species. Meanwhile caution should be used in planting *P. elliottii* in areas with less than the indicated rainfall. *From author's summary.*

4130. Schmidt, R. L. **Factors controlling the distribution of Douglas Fir in coastal British Columbia.** *Quart. J. For.* 54 (2), 1960 (156–60).

Indications are that the natural distribution of Douglas Fir in coastal British Columbia is, to a great extent, not under direct climatic control, but is influenced by the incidence of forest fires. It is thought that large areas, now supporting more shade-tolerant species, can be successfully converted to Douglas Fir by artificial means.

4131. Logan, L. A. **An ecological study of the American Beech along the southwestern border of its distribution.** *Abstr. of thesis*, in *Dissert. Abstr.* 20 (9), 1960 (3487). O.R.S.

Data were collected from 29 field stations. Beech stands were found principally on soils derived from sandstones, sandy clays and alluvial deposits, in sheltered habitats. Laboratory analyses of surface and subsoil characters showed a high sand % and generally low field-capacity and wilting-coefficient values. Comparison of herbarium specimens from the entire range showed two distinct varieties, var. *caroliniana* in the extreme southern range and var. *grandifolia* in the New England states. Precipitation, particularly winter and spring rainfall, was consistently higher on the border than at weather stations W. of it. Populations were limited to moist sheltered habitats, where the soil was coarse sand and ground water was close. In apparently suitable areas without Beech, lack of a protected habitat or poor drainage appeared to prevent its establishment. The stands along the border constitute relict communities. No seedlings or saplings were observed and young trees only in four of the northernmost stations. Mature trees were present in all stations, but many showed poor form and vigour. Stand decadence increased southwards. It is suggested that populations of Beech are declining along the S.W. border of its distribution.

4132. Gusev, Ju. D., and Sidorov, L. F. K ėkologii *Populus pamirica* Kom. na verhnem predele ego proizrastanija. **[Ecology of *P. pamirica* at the upper limit of its range.]** *Bot. Ž.* 45 (3), 1960 (444–5). 2 refs. [Russ.]

[Cf. *F.A.* 21 No. 1525.] Groves of dwarf *P. pamirica* scrub were found at 3760 and 3850 m. alt. in the Tadzhikistan Pamirs. Some data are given on the sites, and the growth of the trees. Canopy closure is 55–65%, many of the trees have heart rot, and regeneration seems to be almost exclusively vegetative.

4133. Wei, L. **[Preliminary investigations of the distribution of *Quercus variabilis*.]** *For. Sci., Peking* 1960 (1), (70–1). [Chin.]

A brief account of this Oak (valued for its cork), supported by a small distribution map and a diagram showing its altitudinal range in each province (in Yunnan it reaches 2200 m.). It may be found in pure stands, especially round lat. 34° N., long. 110° E., but generally grows in mixture with *Q. acutissima*, *Pinus tabulaeformis*, *P. armandii* and *P. insularis* var. *yunnanensis*. Edible fungi, especially *Hirneola polytricha*, grow on the decaying wood.

4134. Arora, R. K. **Ecology of *Xylia xylocarpa* Taub.** *Indian For.* 86 (5), 1960 (306–13).

The occurrence of *X. xylocarpa* in relation to soil, climate, and topography of the N. Kanara district is discussed. This species, generally supposed to occur on laterite, grows equally well on schist, shale, sandstone, gneiss/granite etc. Its role as an indicator in explaining the succession of forest communities is also discussed.

181.2. Atmospheric Relations. Acclimatization

See also Nos. 3940, 4022, 4129, 4174, 4221, 4254 *et seq.*, 4280, 4332, 4340, 4509 *et seq.*, 4770, 4872.

4135. Vaartaja, O. **Photoperiodism in northern and southern Sugar Maple.** *Bi-m. Progr. Rep. Div. For. Biol. Dep. Agric. Can.* 16 (2), 1960 (2–3). 2 refs.

To test the existence of ecotypic variation in photoperiodic responses in *Acer saccharum*, seed collected from (*a*) Ontario (44° N.) and (*b*) Tennessee (36° N.) was grown under different photoperiods. Few seedlings remained free of fungal infection and no statistical analysis was possible. The total length of the hypocotyl and 3 subsequent internodes for 15- and 21-hour days was 24 and 50 mm. respectively for seedlings from (*a*), and 40 and 41 mm. from (*b*). The marked response of (*a*) seedlings to the longer photoperiod is in accordance with earlier studies and suggests that the northern and southern ecotypes are photoperiodically different. [Cf. *F.A.* 21 No. 208.]

4136. Es′kin, B. I. Antocian i morozostojkost′ rastenij. **[Anthocyanin and the frost resistance of plants.]** *Dokl. Akad. Nauk SSSR* 130 (5), 1960 (1158–60). 13 refs. [Russ.] A.P.B.

After a late frost on 10 May in the Stalingrad region, observations were made on the frost resistance of the leaves and shoots of *Quercus robur* of various ages (seedlings, 1- and 2-year plants, 10-year coppice, and trees 70–80 years old). Results showed that damage increased with increase of age and decrease of anthocyanin content, red-leaved individuals being more frost-resistant than green-leaved. The number of red-leaved individuals decreased from 100% in seedlings from sowings in the preceding autumn to 0·8% in 10-year-old coppice and nil in the old trees. Possible explanations for the association of anthocyanin with frost resistance are discussed; it is thought that the optical properties of anthocyanin, which influence both the nature and quantity of the products of photosynthesis, are very important in this connexion.

4137. Bakuzis, E. V., and Hansen, H. L. **Use of ecographs in analysing species-environmental relationships in forest communities.** *Minn. For. Note* No. 91, 1960. pp. 2.

Describes the procedure and presents parts of ecographs for 28 tree species using (1) moisture/nutrient and (2) heat/light co-ordinates, following a study of 356 forest stands in Minnesota.

4138. Bakuzis, E. V., and Hansen, H. L. **Some relationships between vegetational indication and broad soil groups in Minnesota forest communities.** *Minn. For. Note* No. 90, 1960. pp. 2. [Cf. *F.A.* 21 Nos. 298, 1531.]

181.3. Water, Soil and Root Relations

See also Nos. 3967, 4131, 4137–8, 4267.

181.31. Water Relations

See Nos. 4015–20, 4129, 4208–9, 4779.

181.32/34. Soil and Nutrient Relations

See also Nos. 3953–4, 3962, 3970–1, 4011, 4121, 4134, 4159, 4381, 4516–21, 4603, 4756, 4758–62, 4766.

4139. Swan, H. S. D. **The mineral nutrition of Canadian pulpwood species. Phase II. Fertilizer pellet field trials. Progress report No. 1. (Institute project IR-W133.)** *Woodl. Res. Index Pulp Pap. Res. Inst. Can.* No. 115, 1960. pp. 6.

The urea-formaldehyde pellets contain 24% N and 6% P, by weight. Data are tabulated on the establishment of twenty-two 1000-tree trials with various pulpwood species planted in 1959 at sites from New Brunswick to British Columbia, and on the growth data at the end of the first growing season. In most cases, pelleting alternate rows gave acceptably uniform mean heights. Bottom pelleting appeared to increase mean leader length by 9·26%, but also the casualty % by 3·13%. There appeared to be little difference between bottom and side fertilizer placement. It is expected that the 1960 measurements will clarify the picture as regards growth response and casualties.

4140. Ščerbakov, A. P. Nekotorye dannye o biologii rosta odnoletnih sejancev sosny (*Pinus silvestris* L.) i nakoplenii imi pitatel′nyh veščestv. **[Some data on the growth of one-year *P. sylvestris* seedlings, and their accumulation of nutrients.]** *Trud. Inst. Les.* No. 41, 1958 (122–47). 26 refs. [Russ.russ.]

[Cf. *F.A.* 16 No. 1397; 20 No. 3087.] The seedlings were grown on sandy soil in a nursery near Moscow, and sampled every 10 days from 1 June to 3 Nov. Definite periods of accelerated growth of stems, needles, and roots were noted over the growing season, the periods not coinciding for the various organs. A definite rhythm was also observed in nutrient accumulation, both for the whole plant and for the various organs. Accumulation was greatest in the needles throughout the whole growing season, and least in the stems. Total nutrient requirements (in kg./ha.) for 1-year seedlings at a density of 2·9 million/ha. were calculated at: ash 58·9, N 5·94, K_2O 6·71, CaO 5·6, MgO 7·43, and P_2O_5 6·03.

4141. Strebel, O. Mineralstoffernährung und Wuchsleistung von Fichtenbeständen (*Picea abies*) in Bayern. **[Mineral nutrition and yield of Spruce stands in Bavaria.]** *Forstwiss. Cbl.* 79 (1/2), 1960 (17–42). 68 refs. [G.g.]

Needle samples were collected from pole-sized and mature trees on 69 sites, and their N, P, K, Ca and Mg contents determined. Data were available for 2 years on 53 of the sites. A close positive correlation was found between the N concentrations in the needles and tree height classes. The means of N contents for two successive years were between 1·13 and 1·54%; Spruce with > 1·33% N in the needles were usually in good and very good height classes. The N contents of the organic matter in the soil were also related to the N nutrition of the sample trees: on mull sites, Spruce usually had plentiful N (> 1·3% in the needles), and showed good growth; on moder and raw-humus sites with C/N ratios > 26, N deficiency is probable. Spruce on dry and wet sites, and on sites with considerable seasonal fluctuations in soil m.c. frequently exhibited deficient N nutrition. P concentrations in the needles were also positively correlated with tree height classes. The 2-year means of P contents were between 0·107 and 0·241% and the N/P ratios in the needles between 8 and 10. Other 2-year mean nutrient contents were 0·35–0·92% K, 0·24–0·69% Ca, and 0·11–0·25% Mg; the K/Ca ratio was between 1 and 2·5.

4142. Duchaufour, P., and Bonneau, M. Note sur la physiologie de la nutrition des résineux: applications à la pratique des reboisements [**Note on the physiology of conifer nutrition: practical applications to afforestation.**) *Rev. for. franç.* 12 (4), 1960 (250–6). 5 refs. [F.]

Briefly reviews findings of the Nancy Forest Research Station and in the light of them makes recommendations for fertilizer treatment of soils to be afforested, with special reference to podzols with raw humus, sterile sands with no humus, and young rendzinas with little humus but rich in Ca.

4143. **Tree growth, forest productivity and soil type.** *Extr.* from *Rep. Nat. Conservancy, Lond. 1958/59*, 1959 (50–1).

In an attempt to determine the best method of sampling a forest for dry matter and chemical content, an intensive study was made of a pure Scots Pine stand near Jedburgh. Twenty trees, 4 from each of 5 girth classes, were selected so as to cover almost the whole range of tree size within the plot, the middle-sized class including the average-sized trees for the stand. Dry weight and chemical composition of the leaves, branches, boles and roots of each tree were determined. It was apparent that no truly average tree exists, but by sampling trees of mean size, a fair but slightly low estimate of stand weight and nutrient composition could be obtained. Because the trees within a stand vary so much in size and weight, it is better to sample a number of trees of different sizes rather than an equal number of trees of average dimensions.

Two Forestry Commission thinning trials, near Windsor and Brandon respectively, have been studied to determine the effects of past thinning practice on the weight of average-sized trees, ground flora, and the accumulation of litter on the forest floor. At both sites, the weights of the various components of the average-sized tree (needles, branches, boles and roots) increased with increasing severity of past thinning treatment. For whole stands the results were more complex—the total weight of the ground flora and of branches increased, but that of boles, roots and litter layers decreased with decreasing stocking. The weight of tree leaves also tended to decrease with stocking, but not significantly. Comparison of these results with those of earlier investigations suggests that there is a fundamental relationship between stocking and both leaf mass and branch weight per acre, which is independent of tree age once the canopy is complete.

4144. Ovington, J. D., and Madgwick, H. A. I. **Distribution of organic matter and plant nutrients in a plantation of Scots Pine.** *For. Sci.* 5 (4), 1959 (344–55). 8 refs.

A more detailed account of a study made near edburgh [see preceding abstract].

4145. Ovington, J. D., and Madgwick, H. A. I. **The growth and composition of natural stands of Birch. 2. The uptake of mineral nutrients.** *Plant & Soil* 10 (4), 1959 (389–400). 16 refs.

[Cf. *F.A.* 20 No. 5027.] Sample trees of *Betula verrucosa* from 9 natural Birch woodlands at Holm Fen Nature Reserve were analysed for Na, K, Ca, Mg, P, and N. Tables show the amounts of these elements in the leaves, branches, boles, and, in some cases, the roots of the sample trees, and also in the whole growing stock, for ages 6, 24, 27, 32, 38, 42, 46, 53 and 55 years. The nutrient cycle is discussed in detail. Of the total uptake of the major nutrients by the trees, ca. 77% of the Na, 87% of the K, 74% of the Ca, 81% of the Mg, 85% of the P, and 84% of the N, have been returned to the soil after 55 years.

4146. Greenland, D. J., and Kowal, J. M. L. **Nutrient content of the moist tropical forest of Ghana.** *Plant & Soil* 12 (2), 1960 (154–74). 11 refs.

The total weight of vegetation on an area of just over 1 acre of old secondary forest in the moist forest zone of Ghana was determined, and found to be ca. 150 tons/acre dry weight. The amounts of the major nutrients immobilized in the vegetation (in lb./acre) were: N 1800, P 120, K 800, Ca 2400, and Mg 350. The corresponding amounts of nutrients in the top foot of soil were: total N 4100, "available" P 11, exchangeable K 580, exchangeable Ca 2300, and exchangeable Mg 330. About half the nutrients stored in the vegetation were contained in readily combustible material, and, except for N, would be released to the soil if the forest were cleared and burnt for cultivation. The quantity of roots and the amounts of nutrients contained in them were not enough to make an important addition to the nutrient supply in the soil during subsequent cultivation. Of all the roots supporting the vegetation, 85·5% by weight were within 1 ft. of the soil surface. *From authors' summary.*

4147. Donov, V. Izsledvanija vărhu vlijanieto na elovite i bukovite nasaždenija vărhu počvata. [**The influence of Silver Fir and Beech stands on the soil.**] *Nauč. Trud. Lesoteh. Inst., Sofija* No. 7, 1959 (37–43). 6 refs. [Bulg.g.]

Tabulates data on the mechanical, physical, and chemical composition of the soil under 3 stands of Fir and 3 of Beech, all ca. 100 years old, growing in various zones in Bulgaria. Differences are noted both between zones and between the species. It is concluded that, though both Beech and Fir exert a specific influence on the soil, the final results are not such as to hinder the development of either species.

4148. Badjunina, A. F. Izmenenie fizičeskih svojstv soloncov Ergenej pod vlijaniem kustarnikov. [**Changes in the physical properties of solonetz soils in the Ergeni Hills under the influence of shrubs.**] *Počvoved.* 1960 (4),.(31–9). 13 refs. [Russ.russ.e.] A.P.B.

Trials have shown that plantations of shrubs such as *Tamarix* sp., *Elaeagnus* [*angustifolia*], *Caragana arborescens*, *Acer tataricum*, *A. negundo* and *Rhus cotinus* improve solonetz soils largely by increasing their porosity, permeability and infiltration capacity. These effects, and snow retention by the shrubs, improve the soil moisture supplies and assist in the leaching out of salts. The leaf litter and root exudates decrease the Na content and increase the Ca content of the soil, and also improve its content of organic matter and nutrients. Belts of shrubs are advocated for unirrigated solonetz soils, and block plantations of shrubs where irrigation is possible.

181.35. Special Modes of Nutrition. Symbiotic Relationships. Parasitism

See also Nos. 4520, 4603.

4149. DAVENPORT, H. E. **Haemoglobin in the root nodules of *Casuarina cunninghamiana*.** *Nature, Lond.* 186 (4725), 1960 (653–4). 9 refs.

The respiratory pigment haemoglobin, hitherto detected in higher plants only in root nodules of legumes, has now been found in root nodules of *C. cunninghamiana*, and there are indications of its presence also in those of *Alnus glutinosa* and *Myrica gale*.

4150. BJÖRKMAN, E. ***Monotropa hypopitys* L.—an epiparasite on tree roots.** *Physiol. Plant., Copenhagen* 13 (2), 1960 (308–27). 50 refs. [E.e.]

Experiments were made to test the hypothesis that *M. hypopitys* and associated trees have a common mycorrhizal fungus. By isolating groups of *M. hypopitys* from all tree roots, it was shown that normal development of the plant is dependent on trees. When radioactive glucose (*D*-glucose-C^{14}) was injected into the phloem of mature Pine and Spruce, it was found that it passed into groups of *M. hypopitys* growing beneath them. When labelled phosphorus (P^{32}) was injected into the phloem of a 70-year Pine, it was absorbed by *M. hypopitys* growing at 2 m. from the tree but only to a very slight extent or not at all by *Vaccinium myrtillus*, *V. vitis-idaea*, or *Calluna vulgaris* growing at the same distance from the tree. A mycorrhizal fungus, cultivated from the roots of *M. hypopitys*, produced mycorrhizae in pure culture with Pine and probably also with Spruce seedlings. Extracts of *M. hypopitys* added to cultures of (*a*) this fungus, (*b*) 3 *Boletus* spp., (*c*) *Psalliota arvensis*, and (*d*) *Fomes annosus*, powerfully stimulated growth, particularly of (*a*) and (*b*). In *M. hypopitys* the mycorrhiza is confined to the outermost cell layer of the roots, whereas in the typical ectotrophic mycorrhizae of conifers the fungus usually penetrates deeper. The investigation suggests that *M. hypopitys* has its mycorrhizal fungus in common with the tree with which it is associated; that this fungus is stimulated by a substance occurring in *M. hypopitys*, whereby mycorrhizae form; and that nutrient material passes from the trees to the plant via the common mycorrhizal fungus. The rapid development of *M. hypopitys* in late summer coincides with optimum production of mycorrhizae. Thus it can be regarded as an epiparasite on the roots of certain trees with ectotrophic mycorrhizae. *From author's summary.*

4151. **Mycorrhizal development on tree seedlings.** *Extr.* from *Rep. Pacif. Nthwest. For. Range Exp. Sta. 1958*, 1959 (21–2).

In culture tests with various fungi and *Pinus ponderosa*, only *Amanita pantherina* formed mycorrhizae at 30° C. Mycorrhiza development on Douglas Fir, *P. ponderosa* and *P. radiata* seedlings grown in jars at controlled temperatures in soils inoculated from a fairly cool, moist Douglas Fir site, was markedly inhibited at soil temperatures of 30° C.

4152. LEVISOHN, I. **Effects of *Gibberella fujikuroi* on fungal root-infections of *Pinus*.** *Nature, Lond.* 186 (4729), 1960 (987–8). 5 refs.

Injection of *G. fujikuroi* into the soils of pot cultures of *P. sylvestris* (two podzols and an agricultural soil) in all cases depressed initial growth of the seedlings, reduced mycorrhizal infections and increased harmful (haustorial) infections. Mixed cultures on a nutrient agar medium showed the antagonistic effects of *Gibberella* on several mycorrhiza-formers.

181.36. Root Relations and Root Development etc.

See also Nos. 4014, 4038, 4069, 4159–60, 4544, 4584.

4153. **Low temperatures and root growth.** *Extr.* from *Rep. Imp. For. Inst., Oxf. 1958/59*, 1959 (15).

It was found earlier that, when grown with their roots at 36° F. but crowns at 60°, Sitka Spruce developed roots normally, though root development of Japanese Larch was inhibited. A similar trial has now been made with Green Douglas Fir and Corsican Pine. The Douglas grew more slowly, but satisfactorily. The growth of Corsican Pine was, however, markedly retarded, though not to the same extent as that of Japanese Larch.

4154. ARMSON, K. A., and WILLIAMS, J. R. M. **The root development of Red Pine (*Pinus resinosa* Ait.) seedlings in relation to various soil conditions.** *For. Chron.* 36 (1), 1960 (14–7). 2 refs.

Red Pine seedlings were grown in calcareous and non-calcareous, weathered and non-weathered, compacted and loose soils for ca. 3 months. Their root development at the end of this period was found to be reduced only by the compacted soil treatment; no other variable had any significant effects. The Ca concentration of the tops of those seedlings grown in calcareous soil was about double that of those grown in non-calcareous soils. *From authors' abstract.*

4155. FISCHER, F., BAZZIGHER, G., and KOBERT, H. Künstlich hergestellte Wurzelverwachsungen. **[Artificial root grafts.]** *Mitt. Schweiz. Anst. Forstl. Versuchsw.* 36 (1), 1960 (15–32 + 6 photos). 26 refs. [G.g.f.it.e.]

Successful unions (the authors prefer to call them anastomoses, or "root intergrowths" to avoid confusion with root grafting as a propagation technique) were obtained between roots (1·5–4 mm. thick) of separately potted 5-year-old Spruce trees, the roots being set either parallel (in either the same or the opposite direction of growth), or at an angle. Root tips did not form unions. When a 1% streptomycin solution was introduced into one plant by stem injection or by absorption through a cut stem surface, antibiotic effects could be observed after 12 hours in stem fragments of both plants placed in a fungus culture; stem fragments taken before application of the antibiotic had no such inhibiting effect. Transfer of acid fuchsin was also observed, though absorption was slow and it took 60 hours for the colour to appear (in cuts) at the top of the receptor plant. A fluor-chromium method with aureomycin, allowing the tracing of the transported substance by fluorescent microscopy, showed promise.

4156. Graham, B. F. **Transfer of dye through natural root grafts of *Pinus strobus* L.** *Ecology* 41 (1), 1960 (56–64). 18 refs.

Observations of physiological interaction between *Pinus strobus* trees in an uneven-aged (54-year mean) old-field stand in New Hampshire are presented. Acid fuchsin dye, introduced through the tops of 10 freshly cut stumps, was observed to enter their sapwood and to move, through natural root grafts, to intact trees near by. From 7 of the 10 treated stumps, dye moved into 13 adjacent receptor trees via 31 major roots. Dye was taken in most rapidly during the first 24 hours, and intake continued, at a diminishing rate, for 9 subsequent days of observation. It is suggested that uptake which continues for more than a day or two may be, in itself, an indication that a stump is grafted to adjacent intact trees. Repeated sprouting of tree stumps, and continued growth of girdled trees, as sometimes encountered, probably also indicate the presence of natural grafts. After a prolonged dry period, meteorological conditions that should have stimulated transpiration by the intact trees, coincided with increased dye intake by 70% of the stumps. This apparent relationship suggests that trees may be influenced by environmental factors not only directly, but also indirectly through their grafted companions. No periodicity or diurnal variation in intake rate was demonstrated. It is suggested that an unusually dry summer (1957) may have resulted in minimum transpiration, essentially cuticular, and in absence of the normal daily rhythm. [Cf. *F.A.* 21 No. 1559.] *From author's summary.*

4157. Chattaway, M. M. **Lignotubers.** *Victorian Naturalist, Melbourne* 75 (5), 1958 (81–3). 1 ref. O.R.S.

The occurrence and development of lignotubers in Eucalypts are described. Of 46 species examined, the majority had two concealed buds, one below and one above the usual axillary bud, from which lignotubers arose; but some species, including *E. astringens*, *E. rostrata*, *E. diversicolor*, and *E. pilularis* produced none. The following, with only one concealed bud, also produced no lignotubers: *E. flocktoniae*, *E. fraxinoides*, *E. lehmannii*, *E. nitens*, *E. oreades*, and *E. regnans*. [Cf. *F.A.* 20 No. 4283.]

4158. Krasil'nikov, P. K. Nekotorye osobennosti kornevyh sistem pjati vidov *Euonymus* v dvuhletnem vozraste v uslovijah Leningradskoj oblasti. **[Some features of the root systems of five *Euonymus* spp. at two years of age in the Leningrad region.]** *Bot. Ž.* 45 (3), 1960 (394–7). 8 refs. [Russ.]

The species studied could be divided into three groups (*E. europaeus* and *E. maackii*; *E. hamiltonianus* and *E. yedoensis*; *E. verrucosus*) by type of root system and vigour of growth. The root systems are illustrated.

181.4. Reaction to Biotic Influences (Competition etc.) and Fire

See also Nos. 4019, 4130, 4152, 4184–7, 4211, 4539.

4159. Karpov, V. G. Konkurencija kornej derev'ev i soderžanie pitatel'nyh veščestv v list'jah rastenij travjano-kustarničkovogo jarusa taežnyh lesov. **[Tree root competition and the nutrient contents in leaves of the herbaceous and shrub layers in taiga forests.]** *Dokl. Akad. Nauk SSSR* 129 (5), 1959 (1183–6). 13 refs. [Russ.] A.P.B.

The investigations were made in a Spruce stand [see *F.A.* 20 No. 4320], and a 26-year-old Birch stand, using the trenching method already described. The ash, N, P, and Ca contents of leaves of *Oxalis acetosella*, *Calamagrostis langsdorfii*, *Vaccinium myrtillus* and *Aegopodium podagraria*, and the pH and available N and P of the soil were determined. The principal conclusions reached are that in these communities: (1) the nutrient contents of such plants are affected by root competition from the trees—a point to remember when plant analysis is used as an index to soil nutrient status; (2) the roots compete mainly for available forms of N.

4160. Karpov, V. G. Osnovnye itogi èksperimental'nyh issledovanij vzaimootnošenij meždu rastenijami v lesah srednej tajgi. I. **[Basic results of investigations on the interrelationships of plants in forests of the central taiga zone. I.]** *Bot. Ž.* 45 (2), 1960 (161–80). 43 refs. [Russ.e.]

[Cf. preceding abstract.] The first of a series of reports on synecological studies with special reference to succession, in the climax *Piceetum myrtillosum* (1) and in the seral communities of Birch with *Vaccinium myrtillus* and *Calamagrostis* (2) deriving from (1) [after clear felling]. Data are given on the weight of roots in the soil; the seed germination and the development and mortality of young Spruce in (1) and (2); and the influence of mature trees (Spruce, Birch) on the growth and seasonal development of seedlings. It is concluded that the poor growth of Spruce regeneration in (2), which greatly retards natural succession, is due as much to root competition as to competition for light. In (1), however, Spruce seedlings are more adversely affected by shortage of light than by root competition. The importance is stressed of silvicultural measures to reduce root competition by mature Birch.

4161. Sickle, F. S. van, and Hickman, R. D. **The effect of understory competition on the growth rate of Ponderosa Pine in North Central Oregon.** *J. For.* 57 (11), 1959 (852–3). 8 refs.

A study to determine whether the reduction in density of undergrowth (reproduction, brush and herbaceous vegetation) in (1) an area burned in 1938, could be correlated with an increase in growth of residual trees, compared with (2) an adjacent unburned area. Diameter growth in 1948–57 was much greater on (1) than on (2). However, it was not possible to find a definite correlation between growth rate and vegetation density, because the many other unmeasured or uncontrollable factors affecting growth obscure any possible relationship.

181.5. Reproductive Behaviour

See also Nos. 3950, 4032–6, 4040, 4157, 4160, 4170, 4175, 4221, 4231 *et seq.*

4162. **[Study of flowering and fruiting, and assessment of the seed production of *Cunninghamia lanceolata*.]** *For. Sci., Peking* 1960 (1), (8–13). [Chin.russ.]

Observations were made at 980 m. alt. in S. Szechwan province on the flowering and fruiting of 6 sample trees (all ca. 60 years old; height 20 m.; d.b.h. 30·1 cm.). Shoots with ♀ flowers were mainly in the upper crown; shoots with ♀ and ♂ in the middle; and shoots with ♂ flowers in the lower crown. Flower buds formed in July, the flowers developing in the following March. ♂ flowers usually predominate in dense stands, and ♀ ones at stand margins and on free-growing trees. Dense stands produce fewer cones than open stands; cones in the upper crown are bigger and heavier than those lower down. The possibilities of using flower bud counts to estimate next year's seed production are discussed.

4163. CHANDLER, C. **Bisporangiate cones in Larch.** *Contr. Boyce Thompson Inst.* 20 (1), 1959 (107–10). 5 refs.

In 1958, twenty-six bisporangiate strobili were observed on one tree of *Larix leptolepis* growing at Yonkers, N.Y. Ten of these were self-pollinated, tagged, and covered with paper bags. At maturity the cones were collected and examined. Most of the seeds were empty and only 8 well developed embryos were observed. In normal cones at least 50% of seeds are viable.

4164. **Dispersal of Ponderosa Pine seed.** *Extr.* from *Rep. Pacif. Nthwest. For. Range Exp. Sta. 1958*, 1959 (24–5).

Observations in November of a good seed-year showed a sharp drop from 130,000 seeds/acre at the edge of a clearing in a virgin stand to an average of 33,500 (47,000 with and 20,000 against the prevailing wind) two chains away, and a steady drop to 7,300 at the centre of the clearing, 8 chains away from the edge. In the stand itself, the average was 338,000/acre.

4165. CHOWDHURY, A. K. **A short note on *Shorea assamica* (Mekai).** *Indian For.* 86 (4), 1960 (205–6).

The author was for 3 years in charge of a Mekai forest in N.E. Frontier Agency. The absence of natural regeneration was noted. Possible causes were: long intervals between seed-years; lightness of the seeds, which cannot penetrate the ground vegetation; heavy weevil attacks (90% of seeds are destroyed while still on the tree). Tests in two poor seed-years showed that in 1957 seed matured in the first fortnight of March. In 1958, maturity was delayed until April, seed collected in Feb. and March failing completely. When seeds were dibbled in April into small beds (*thalis*) dug at 9 × 9 ft. spacing in a ½-acre plot under moderate canopy, 35% germination was obtained. These seedlings are growing well. It is concluded that artificial plantations of Mekai could be raised under forest conditions, given a good seed-year, careful timing of seed collection, and the provision of adequate shade for seedlings.

4166. BAKER, H. G., and HARRIS, B. J. **Bat-pollination of the Silk-cotton Tree, *Ceiba pentandra* (L.) Gaertn. (*sensu lato*), in Ghana.** *J. W. Afr. Sci. Ass.* 5 (1), 1959 (1–9 + 1 plate). 15 refs. H.S.B.

Describes the flowering of *C. pentandra* and visits to open flowers by *Epomophorus gambianus*, *Nanonycteris veldkampii* and *Eidolon helvum*, and discusses the rôle of these fruit bats in its pollination.

4167. TSCHIRLEY, F. H., and MARTIN, S. C. **Germination and longevity of Velvet Mesquite seed in soil.** *Journal of Range Management, Berkeley* 13 (2), 1960 (94–7). 2 refs. A.P.B.

In germination tests with *Prosopis juliflora* var. *velutina* near Tucson, Ariz., most of the seed (1948 harvest, planted in Aug. 1948 at 3000 and 3800 ft. alt.) that germinated did so during the 1949 summer rainy season. At 4000 ft. about equal amounts germinated in 1949 and 1950. Little germination took place in or after 1951, and none after 1954. Total germination rates were 15·3% for hulled seed and 44·7% for seed planted in pod segments. When hulled seed was stored in small jars, with perforated lids, containing some soil and buried 6 in. deep on each of the three sites, mean recovery of apparently sound seed (i.e. neither germinated nor decayed) fell from 63% after two years to 47% after five and 10% after ten years. These seeds retained germination %s of > 80 in the laboratory. [Cf. *F.A.* 17 No. 2820.]

181.6. Life Form, Habit. Post-Seedling Development and Form

See also Nos. 4143, 4172–3, 4397–8, 4766–7, 4772–5, 4779.

4168. **Crown and stem development of Douglas-Fir.** *Extr.* from *Rep. Pacif. Nthwest. For. Range Exp. Sta. 1958*, 1959 (18–9).

In a study of 6 trees, aged 35 to 70 years, branch characteristics and rate of death of branch whorls were fairly constant for each tree but varied widely between trees. Diameter growth, but not height growth or stem form, was generally related to the ratio of live crown and bole length. The number of annual rings in live branches of healthy appearance was often less (by ⩽ 15) than that in the stem at the point of origin [cf. *F.A.* 21 No. 824].

181.7. Duration, Longevity, Stature; Records of Exceptional Age or Size. Effects of Age on Behaviour

See also No. 4331.

4169. SUZUKI, H. **[Studies on the growth of Nikko Avenue Cedars (*Cryptomeria japonica* D. Don.—so-called "Nikko Namiki Sugi").]** *Bulletin of the College of Agriculture, Utsunomiya University* 4 (1), 1958 (27–52). 19 refs. [Jap.e.*e*.] C.G.B.

Presents the results of a study of this famous old avenue [cf. *F.A.* 21 No. 1552]. Data are given on d.b.h., height, and single-stem volume. A difference is observed in growth on the shady and sunny sides. In comparison with other plantations, the Nikko Avenue Cedars show decidedly inferior height growth, though a not so inferior diameter growth. This checking of height growth seems to have occurred from the 50th year and is probably due to site and climatic factors. *From author's summary.*

181.8. Phenology

See also Nos. 4026, 4058–9, 4135, 4332, 4779.

4170. Senčukova, G. V. Fenologičeskie nabljudenija nad *Taxus cuspidata* S. et Z. [**Phenology of *T. cuspidata*.**] *Bot. Ž.* 45 (3), 1960 (415–8). 2 refs. [Russ.]

Reports phenological observations (1946–59) on a single specimen in an arboretum at Khabarovsk. This specimen is monoecious, bearing ♂ and ♀ flowers every year.

4171. Asada, S. [**Study on the rest period of *Larix* Mill.**] *Journal of the Faculty of Agriculture, Shinshu University, Nagano* No. 8, 1958 (1–24). 23 refs. [Jap.jap.e.*e*.] C.G.B.

A detailed study over 3 years, in two parts. (I) With *L. leptolepis*, 5 branches each of the upper, middle and lower crown of a 5-year sapling were stripped of all needles every 14 days from July 11 to Sept. 19, i.e. from 6 saplings in all, in succession. Tables and graphs show the time elapsing before the terminal buds of the stripped branches formed and opened, and the total number of buds that formed and opened on each branch after 28 days. Results were observed over two successive winters. The length of rest period for the buds that did not respond to the stripping by premature opening was practically the same in both. Changes in water contents, crude albumen, starches, sugars and ash are also graphed. (II) With *L. leptolepis* (5 provenances), *L. decidua* (4), and *L. gmelinii* (3), the current year's branches were stripped from one sapling of each [age not stated], every 14 days from July 28 to Oct. 3, i.e. from 7 saplings of each provenance, in succession, and similar observations maintained for one winter. Results showed that the *L. gmelinii* of all provenances broke dormancy far earlier (Dec. 6–25) than the other species (Feb. 5–20). Some height-growth data for *L. leptolepis* and *L. decidua* at 25–32 years, in Japan and Europe, are also compared.

4172. Hess, D. W. **Ecological studies of the growth of Ponderosa Pine on the east slope of the Rocky Mountain Front Range in Boulder County, Colorado.** *Abstr. of thesis*, in *Dissert. Abstr.* 20 (10), 1960 (3935). O.R.S.

Diameter growth at a height of 1 m. of five individuals of *Pinus ponderosa* var. *scopulorum*, growing at 7500 ft. alt., was measured with a dial-gauge dendrometer in two consecutive seasons. Cross-sections of cambial and adjacent tissue were also measured. Growth began early in May, when mean air and soil temperatures reached 50° F., and 50% of the diameter increase was completed within 30 days, a more rapid rate of growth than is found in other ecotypes of Ponderosa Pine. Growth rate was constant and apparently unaffected by the seasonal trend of rising temperature and decreasing soil moisture. Three rows of phloem parenchyma were produced in a single season, in contrast to White Pine, which produces only one row. Crushing of new sieve elements occurs as early as the latter part of June. Diameter growth appears to be essentially complete and cambial activity to cease by the end of August; completion of diameter growth appears not to be directly correlated with soil drought or decreasing temperature but to be autogenous in its onset.

4173. Kovalenko, M. P. Mnogohvojnost′ vtoričnyh (letnih) pobegov *Pinus silvestris* L. i *Pinus pallasiana* Lamb. na Nižnedneprovskih peskah. [**Leaf bundles with supernumerary needles on Lammas shoots of *P. sylvestris* and *P. nigra* var. *caramanica* on the Lower Dnieper sands.**] *Bot. Ž.* 45 (1), 1960 (152–3). 1 ref. [Russ.]

Instances the formation of Lammas shoots in 1954 on Pines in plantations 1–5 years old growing on sands with a high water-table, and, in the exceptionally wet year 1955, even on trees on sites with a deep water-table. The shoots formed in June/July, usually grew for < 30 days, and appeared to occur on the trees of average and better growth. The needle bundles on these shoots mostly contained 3 or, more rarely, 4–5 needles. No Lammas shoots were observed in plantations 10–20 years old.

4174. Mándy, G., and Kárpáti, I. Fafajok rügyfakadási hőigényének meghatározása. [**Determination of the temperatures required for flushing by various tree species.**] *Időjárás, Budapest* 62 (5), 1958 (261–6). 5 refs. [Hu.hu.g.] L.S.

Cuttings from 10 trees of different species were placed in cylinders containing tap-water on March 8, and kept in thermostats at temperatures from 5° to 40° C. in 5° intervals. The number of days required, at each temperature, for flushing to start and to be completed is tabulated. *Betula verrucosa* started flushing after 8 days at 5°, and reached its optimum (shortest incubation and shortest development period) at 20°. *Carpinus betulus* started after 5 days at 5°, and had its optimum at 25°. Other species flushing at 5° were *Tilia cordata* (12 days) and *Aesculus hippocastanum* (24 days). *Prunus armeniaca*, *Morus alba*, *Fraxinus ornus* and *Quercus robur* required 14 days at 10°, *F. oxycarpa* and *F. excelsior* v. *pendula* ≥ 13 at 15°, and *Fagus sylvatica* 16 at 20°. The results of this laboratory method corresponded quite well with data on phenology etc. found in the literature.

4175. Kokšarova, N. E. Fenologičeskie nabljudenija za saksaulom *Haloxylon aphyllum* (Minkw.) Iljin. [**Phenological observations on *H. aphyllum*.**] *Bot. Ž.* 45 (2), 1960 (254–9). 6 refs. [Russ.]

Observations, mainly of flowering and fruiting, were made from 1948 to 1953 on trees 6–10 years old in stands established by direct sowing in the Shafrikan forest along the Bokhara oasis (Uzbekistan). Results to date show that the trees bear fruit annually but the crop varies, and depends on air temperature and humidity, and on the activity of gall-forming organisms.

182. Synecology, Plant Sociology: General. Principles and Methods

4176. Plaisance, G. Les formations végétales et paysages ruraux: lexique et guide bibliographique. **[Plant associations and vegetation types: dictionary and bibliographical guide.]** Gauthier-Villars, Paris. 1959. pp. 421 + 24 photos. [F.] Price *N. Fr.* 30.

Comprises (1) a dictionary of terms (French, scientific, and foreign) for plant associations and vegetation types, with many small maps showing their distribution in France; (2) index of French place names referred to in (1); (3) an index of French surnames derived from plants and plant formations; (4) an index of French dialect names of trees and shrubs; (5) a trilingual [F.G.E.] glossary of names of vegetation types; (6) a vocabulary of terms from ecology and plant morphology; (7) an 87-page bibliography of plant ecology, arranged alphabetically under authors, but with a geographical index.

182.1. Palaeoecology. History of Vegetation. Pollen Analysis

See also Nos. 4044, 4056, 4080, 4127, 4184, 4192–3, 4378, 5215.

4177. Davis, M. B., and Goodlett, J. C. **Comparison of the present vegetation with pollen-spectra in surface samples from Brownington Pond, Vermont.** *Ecology* 41 (2), 1960 (346–57). 24 refs.

Pollen frequencies of tree species showed little quantitative relation to the basal area %'s recorded in the forest sample plots in the vicinity of the pond.

4178. Hauff, R. Drei neue Pollenprofile aus Nord- und Südwürttemberg. **[Three new pollen profiles from N. and S. Württemberg.]** *Mitt. Ver. Forstl. Standortskunde ForstpflZücht.* No. 9, 1960 (16–25). 13 refs. [G.]

Presents profiles from the lower Neckar region, the N.E. Schwarzwald and Upper Swabia, with special attention to the Sub-Atlantic period. Radiocarbon dating of woods found at a depth of 1·9 m. gave an age for the layer of 5500–5900 years. This corresponded well with the pollen-analysis record, indicating Firbas' Zone II [see *F.A.* 13 No. 3702] or early Atlantic period.

4179. Hauff, R. Die buchenzeitlichen Pollenprofile aus Nord- und Südwürttemberg. **[The pollen profiles of the Beech period in N. and S. Württemberg.]** *Mitt. Ver. Forstl. Standortskunde ForstpflZücht.* No. 9, 1960 (26–30). 24 refs. [G.]

Discusses 43 profiles of the Sub-Atlantic period, showing a fair uniformity for each of the 17 growth districts distinguished, with Beech predominating in 5 of the 9 regional forest types and Oak or Silver Fir in the others.

4180. Marchesoni, V. Importanza del fattore storico-climatico e dell'azione antropica nell'evoluzione della vegetazione forestale dell'Appennino Umbro-Marchigiano. **[The importance of the historical-climatic factor and human action in the evolution of the forest vegetation of the Apennines of Umbria and the Marches of Ancona.]** *Ann. Accad. Ital. Sci. For.* 8, 1959 (327–43). 24 refs. [It.f.] [Cf. *F.A.* 20 No. 1587.]

182.2. Succession, Alternation and Periodicity in Vegetation

See also Nos. 4002–3, 4121, 4131, 4134, 4160, 4195, 4199, 4205, 4210, 4229–30, 5215.

4181. Bel'kov, V. P. Nekotorye zakonomernosti razvitija živogo pokrova na vyrubkah. **[Some patterns in the development of plant cover on clear-felled areas.]** *Dokl. Akad. Nauk SSSR* 130 (6), 1960 (1370–3). 11 refs. [Russ.] A.P.B.

Investigations were made on clear fellings in the Leningrad region in (1) the *Piceetum oxalidosum*, and (2) the *P. myrtillosum*, where *Calamagrostis* spp., *Deschampsia caespitosa*, *Agrostis vulgaris* and *Epilobium angustifolium* were typical. Seeds of these plants were able to germinate on forest litter, whereas Spruce seeds could not, and so were able to invade the clearings. Growth of *E. angustifolium* checked the other species. Trends were the same in (1) and (2), but invasion tended to be slower in (2).

4182. Kuklina, L. A. Dinamika vidovogo sostava travjanogo pokrova na lesnyh vyrubkah severa Sverdlovskoj oblasti. **[Changes in the species composition of the herbaceous cover on felled areas in the N. Sverdlovsk region.]** *Bot. Ž.* 45 (1), 1960 (90–7). 13 refs. [Russ.]

Tabulates data for the *Pinetum vacciniosum*, the *P. herboso-vacciniosum* and the *Pinetum* with *Calamagrostis* and mixed herbaceous species, both before felling, and for various periods up to 6 years after felling.

4183. Rogers, D. J. **Ecological effects of cutting in Southern Wisconsin woodlots.** *Abstr. of thesis*, in *Dissert. Abstr.* 20 (6), 1959 (1994–5). O.R.S.

Describes the results of selective or clear felling in 87 hardwood stands, representing a gradient from pioneer to terminal [climax] stands, and ranging from heavily and recently felled to comparatively undisturbed. Subjects covered include the effect of felling on the number of trees, saplings and multiple stems and on the sprouting of different species in different conditions, and the variation of the effect with the continuum index [cf. *F.A.* 13 No. 1074]—e.g. felling in stands with a continuum index > 1300 may eliminate, and with < 1300 may perpetuate, pioneer Oak forest. Heavy felling has probably perpetuated Oaks in many stands by a combination of stump sprouting and release of saplings. The associated regeneration is of pioneer species often considered undesirable. Oaks > 100 years old (the age of many stands in the area) often sprout poorly. The species composition of a relatively pioneer stand that had had a surface fire was compared with that of an adjacent unburnt stand; many tolerant saplings were killed but certain pioneer species survived. In view of the difficulty of establishing Oak regeneration in the past, an investigation of the use of the selective action of fire on tolerant species should be made.

4184. Cooper, C. F. **Changes in vegetation, structure, and growth of South-Western Pine forests since white settlement.** *Ecol. Monogr.* 30 (2), 1960 (129–64). 86 refs.

Deals with the forests (mainly Ponderosa Pine) of northern Arizona, first reviewing the historical evidence and then the evidence derived from analysis of existing stand structure. The most important change brought about by the white man has been the virtual exclusion of fire, which has resulted in large areas of dense Pine thicket. Management problems are discussed.

4185. Brown, J. H., Jr. **The role of fire in altering the species composition of forests in Rhode Island.** *Ecology* 41 (2), 1960 (310–6). 24 refs.

Burned areas were compared with unburned to determine the effect of fire on the species composition of woodlands on upland sites. In 1956 and 1957, samples were obtained from burned areas ranging from 5 years to 51 years since burning, and from areas showing no sign of having been burned. Fire has altered species composition, the tolerant species and the species reproducing by seed having been greatly reduced. The intolerant sprouting species capable of surviving fire, including *Quercus alba*, *Q. coccinea* and *Q. velutina*, are the major occupants of burned areas. These three species predominate in all size classes, indicating that the species composition will remain Oak indefinitely. The Oaks are important constituents of unburned stands, but other species, including *Pinus strobus*, *Tsuga canadensis*, *Fagus grandifolia*, *Betula lenta* and *B. lutea* generally occur in all size classes. It is likely that in future stands, these species will increase in the overstorey. The prevalence of Oak in both burned and unburned stands is apparently the result of a long history of disturbance and burning. *From author's summary.*

4186. Habeck, J. R. **The ecology of White Cedar swamps in Northern Wisconsin with special attention to their role as winter deer range.** *Abstr. of thesis*, in *Dissert. Abstr.* 20 (6), 1959 (1991–2). O.R.S.

A detailed study was made on the effect of winter activity of *Odocoileus virginianus* on the physical environment and botanical composition of the swamps. Activity by the deer was found to create more mesic conditions in the swamps, permitting the encroachment of a more mesic understorey vegetation; the greater dryness, combined with the decrease in regeneration of White Cedar (*Thuja occidentalis*) caused by heavy browsing, have created conditions unfavourable to the continuance of such swamps. In many lowland swamps in N. Wisconsin browsing has destroyed the lowest branches essential to abundant vegetative reproduction, and many of these swamps would now be unable adequately to replace the Cedar regeneration even in the complete absence of deer disturbance. Two artificial methods of regeneration, (1) the use of cuttings, with or without growth regulators, (2) the tipping over of entire Cedar trees, were tested inside protective exclosures. Only a low % of cuttings, but a high % of the trees artificially tipped over, established themselves; the latter were, however, damaged by rabbit browsing. A study of genetic variation showed an upland and a lowland White Cedar ecotype [cf. *F.A.* 20 No. 150]; this factor should be noted when seed for reforestation programmes is collected.

4187. Habeck, J. R. **Winter deer activity in the White Cedar swamps of Northern Wisconsin.** *Ecology* 41 (2), 1960 (327–33). 22 refs.

The influence of white-tailed deer [*Odocoileus virginianus*] on the physical environment and vegetation of their winter range was studied in northern Wisconsin. A description of the development and use of an objective method of measuring the intensity of winter deer activity in White Cedar swamps is presented. This method, called the 'deer activity index', was used in ordering the data collected on the vegetation and physical features of the soils of Cedar swamps. Winter deer disturbance significantly affected the soils in Cedar swamp deer yards. These changes in soil seem to be closely related to changes taking place in the understorey vegetation. The study indicates that winter activity is influencing markedly the over-all stability of Cedar swamps in northern Wisconsin. The result of severe and prolonged winter deer disturbance in such swamps seems to be their replacement by a more mesic vegetation. *From author's summary.*

182.3. Units of Vegetation (Associations etc.): Theory

See Nos. 4183, 4207.

182.4. Layer Communities

See also Nos. 4143, 4161, 4181–2, 4190–1, 4199, 4245.

4188. Hosokawa, T., and Omura, M. **On a brief study of community dynamics of epiphytes.** *Repr.* from *Memoirs of the Faculty of Science, Kyushu University, Fukuoka* 3*E* (1), 1959 (43–50). 8 refs. [E.]

A report of epiphyte community dynamics during 1953–58 in permanent quadrats established in the crown, on boughs and on the stem of Beech trees growing at 1160 m. alt., on Mt. Hiko, S.W. Japan.

4189. Omura, M., and Hosokawa, T. **On the detailed structure of a corticolous community analysed on the basis of interspecific association.** *Repr.* from *Memoirs of the Faculty of Science, Kyushu University, Fukuoka* 3*E* (1), 1959 (51–63). 7 refs. [E.]

Presents results of studies of the *Thuidium cymbifolium*/*Homaliodendron scarpellifolium* epilia on Beech stems, Mt. Hiko, S.W. Japan.

182.5. Synecological Measurements and Methods

See also Nos. 4137–8, 4745.

4190. Cain, S. A., and Castro, G. M. de Oliveira. **Manual of vegetation analysis.** Harper

& Brothers, New York. 1959. pp. xvii + 325. 425 refs. Price [£3].

Discusses, on the basis of an extensive literature, the chief concepts and methods of vegetation analysis, with special regard to the problems of the tropics, under the following main headings: floristics; the community—synusial structure of vegetation; major vegetation types of the world, with the tropical rain forest as an example; analysis of vegetation—reconnaissance, primary and intensive survey, sampling systems etc.; problems of number—abundance and density; problems of pattern—frequency; problems of dominance—coverage; size of sample units; the combination of community characteristics; concepts important in synthesis—presence and constance, fidelity, exclusiveness; and life form and leaf size. The examples, mostly taken from the Western hemisphere, include original work by the authors on the vegetation of Brazil [cf. *F.A.* 19 No. 2854].

4191. KARMANOVA, I. V. Nekotorye priemy opredelenija obilija vidov travjano-kustarničkovogo jarusa taežnyh lesov. **[Some methods of determining the abundance of species in the herb and shrub layer of taiga forests.]** *Bot. Ž.* 45 (2), 1960 (238–48). 23 refs. [Russ.russ.]

Compares the accuracy of ocular estimation, the quadrat method, the point method, and the line interception method. The last two methods were found the most practical for determining the %s of different species, giving sufficient accuracy with less expenditure of time than quadrats (the most accurate method if enough quadrats are laid out).

187. Vegetation Types

See also Nos. 3964, 3975, 4002–4, 4015, 4176, 4186–7, 4218–9, 4233, 4378–9, 4563, 5214–5.

4192. SCHLENKER, G. Zum Problem der Einordnung klimatischer Unterschiede in das System der Waldstandorte Baden-Württembergs. **[The treatment of climatic differences in the forest site system of Baden-Württemberg.]** *Mitt. Ver. Forstl. Standortskunde ForstpflZücht.* No. 9, 1960 (3–15). 29 refs. [G.]

While growth regions [*Wuchsgebiete*] are usually determined by reference to geography and major climatic differences, the sub-units [*Wuchsbezirke*] take account of minor regional climatic differences as manifested in natural regional or zonal forest communities, reconstructed with the help of pollen analysis, forest history, and plant sociology (e.g. montane Beech/Silver-Fir forest). Their relation to climatic data is discussed.

4193. SCHLENKER, G., and HAUFF, R. Entwurf einer Karte der Regionalgesellschaften für die Wuchsgebiete Neckarland (württ. Teil) und Schwäbische Alb. **[A draft map of regional forest communities for the growth regions Neckarland and Schwäbische Alb.]** *Mitt. Ver. Forstl. Standortskunde ForstpflZücht.* No. 9, 1960 (31–5 + 1 map). 21 refs. [G.]

The distribution of the communities distinguished is based largely on pollen analysis, historical research, and climatic data.

4194. MÜHLHÄUSSER, G. [I] Standortsgliederung für die Wuchsbezirksgruppe "Nördliche Ostalb." [II] Standortsgliederung für die Wuchsbezirksgruppe "Buchen-Tannenwald des Keuperberglandes." **[I. Site classification for the growth sub-region "N.E. Alb". II. Site classification for the growth sub-region Beech/Silver-Fir forest of the Keuper range.]** *Mitt. Ver. Forstl. Standortskunde ForstpflZücht.* No. 9, 1960 (37–47). [G.]

Each unit, named after its natural regional forest community, is briefly characterized as to its topography, soils, parent rock and typical vegetation, and colours and symbols for its representation on site maps are given.

4195. WENDELBERGER, E. Auwaldtypen in Österreich. **[Types of floodplain forest in Austria.]** *Schweiz. Z. Forstw.* 111 (4/5), 1960 (207–17 + 3 photos). 19 refs. [G.f.]

Describes three successional stages of "Auwald" development in the Danube valley, (*a*) from alluvial gravel banks in the river itself, (*b*) alluvial sand banks on slower moving arms, and (*c*) silting-up of dead arms. The first woody vegetation, mostly of shrub Willows, by slowing down the current, accelerates sedimentation and alters its character, so that the ground-level rises fast and development to the type of the "soft Au", dominated either by tree Willows, or by Alders, proceeds within a few years or decades. Further development to the "hard Au" which is no longer periodically but only occasionally flooded and where Oak and Elm predominate, is much slower.

4196. TREGUBOV, V. Évolution des forêts résineuses des pré-alpes de Savoie. Étude phytosociologique. **[The development of the coniferous forests of the pre-alps of Savoy. A plant-sociological study.]** *Ann. Éc. Eaux For. Nancy* 16 (2), 1959 (169–232). 20 refs. [F.e.g.]

The climax forest is here represented by a mixed *Picea/Abies/Fagus* high forest with *Abies alba* predominating. A number of sub-associations are distinguished and described.

4197. TREPP, W. Waldgesellschaften im Churer Stadtwald und ihre forstliche Behandlung. **[Forest plant communities in the communal forest of Chur [Grisons] and their silvicultural treatment.]** *Schweiz. Z. Forstw.* 111 (4/5), 1960 (224–51 + 1 map, 2 photos). 8 refs. [G.f.]

Based on a plant-sociological site map of the region (1562 ha.). Of the 14 types described, the *Abietetum albae* and the *Carici-Fagetum abietetosum* are the most important.

4198. HORVATIĆ, S. Tipološko raščlanjenje primorske vegetacije gariga i borovih šuma. **[Typological classification of the garrigue and Pine grove vegetation of the east Adriatic coastal land.]** *Acta Botanica Croatica* 17, 1958 (7–98). [Croat.g.f.] From *abstr.* in *Biol. Abstr.* 35 (8), 1960 (No. 20273).

4199. BHATNAGAR, H. P. **Plant communities in some Sal (*Shorea robusta*) forests of U.P.** *Indian For.* 86 (3), 1960 (139–51). 10 refs.

The floristic composition of some representative samples of some Uttar Pradesh Sal forests has been worked out to differentiate the constituent plant communities and their successional trends. In all, 7 plant communities were recognized. *From author's summary.*

4200. BÉGUÉ, L. Les forêts de l'Inde du Sud. **[The forests of South India.]** *Bois For. Trop.* No. 71, 1960 (3–17). [F.e. span.]

Observations made during a tour, including a comparison of Champion's classification of forest types with that adopted at the Yangambi Congress for African forests.

4201. SATYANARAYAN, Y. **Ecological studies of the Elephanta Island [Bombay harbour].** *Travaux de la Section Scientifique et Technique, Institut Français de Pondichéry, Pondichéry* 1 (3), 1959 (99–114). 6 refs. [E.f.]

Five forest associations are distinguished, all more or less degraded through grazing and fuel cutting: (1) a *Tectona grandis*, (2) a *Pongamia pinnata*, (3) an *Erythrina indica*, (4) an *Avicennia alba* and (5) a *Hardwickia/Boswellia* association. The soils under (3) have the highest salt concentrations; those under (1) the lowest, plus the highest % of organic matter. It is thought that under proper management the original climax vegetation of the island could be restored.

4202. MOORTHY, K. K. ***Myristica* swamps in the evergreen forests of Travancore.** *Indian For.* 86 (5), 1960 (314–5).

4203. VIDAL, J. Les forêts du Laos. **[The forests of Laos.]** *Bois For. Trop.* No. 70, 1960 (5–21). 32 refs. [F.e.span.]

Distinguishes and describes the following types: lowland—(1) dense, moist semi-deciduous forest with Dipterocarps, (2) other dense, moist forests, (3) secondary forest, (4) Dipterocarp woodland, (5) mixed deciduous forest, (6) Teak forest, and (7) savanna; highland—(*a*) moist montane forest of Fagaceae and Lauraceae, (*b*) ditto with broadleaved species and *Fokienia hodginsii*, (*c*) Oak forest, (*d*) Pine forest.

4204. DEBAZAC, E.-F. La végétation forestière de la Kroumirie. **[The forest vegetation of Kroumirie [,N. Tunisia].]** *Ann. Éc. Eaux For. Nancy* 16 (2), 1959 (1–133 + 6 photos, 1 map). 108 refs. [F.e.g.]

The area studied is mountainous (up to 1202 m. alt.) with widespread flysch formations and a mean annual rainfall of > 600 mm. (max. 1530 mm.). The main forest types were studied by synecological methods. *Quercus coccifera* forest and a forest type characterized by *Q. suber* occur at the lower altitudes; characteristic species of this zone are *Pistacia lentiscus* and *Chamaerops humilis*. *Q. suber* forest with *Cytisus triflorus*, and *Q. mirbeckii* forest, grow on leached soils in the sub-montane zone; and *Q. mirbeckii* forest with *Ilex aquifolium* and a central-European flora in the montane zone (> 1000 m. alt.). Riparian forest of *Alnus glutinosa* occurs along the permanent rivers. Grazing and fire are responsible for the formation of some degraded communities, e.g. *Arbutus unedo* bush and *Erica multiflora* and *E. scoparia* moorland. *From author's summary.*

4205. WORRALL, G. A. **Tree patterns in the Sudan.** *J. Soil Sci.* 11 (1), 1960 (63–7). 3 refs.

Bands of Acacia trees rhythmically disposed occur on the red sand belt of W. Sudan in a form resembling grass patterns. Aerial and ground observations seem to indicate that they all lie on gentle slopes, approximately along the contour, and that they are as much as 200 m. wide, with similar or wider spaces between them usually patchily covered with grass. Though sometimes tree bands may originate from man, the cause is generally natural and is probably the same as that producing grass patterns. *From author's summary.*

4206. BRENAN, J. P. M. **Central African savannahs.** *Nature, Lond.* 186 (4724), 1960 (505).

A review of *R. Sillans*: "Les savanes de l'Afrique Centrale" [cf. *F.A.* 21 No. 1609].

4207. BAKUZIS, E. V., DUNCAN, D. P., and HANSEN, H. L. **Suggestions for further development of the forest cover type system of eastern North America.** *Minn. For. Note* No. 92, 1960. pp. 2. 4 refs.

Suggests modifications to the system published by the Society of American Foresters [cf. *F.A.* 15 No. 3382], which would be based on the arrangement of permanent cover types on the moisture/nutrient co-ordinate system [cf. *F.A.* 21 Nos. 4137–8]. The application of the proposed method to the Boreal and Northern regions is illustrated.

4208. MCLINTOCK, T. F. **Soil moisture patterns in a northern coniferous forest.** *Sta. Pap. Ntheast. For. Exp. Sta.* No. 128, 1959. pp. 5.

A summary of major soil-moisture trends was prepared from daily measurements from 12 May to 9 Sept., 1955, in a mixed Pine/Fir/Spruce stand with a typical hollow-and-hummock topography, near Orono, Maine. To study how the typically uneven micro-topography affects soil m.c., 4 replicate samples were composited from each of 2 depths (0–6 and 6–12 in. below the A_0 layer) on each of 3 sites. Soils on all sites were shallow stony loams with an impervious layer at 15–30 in., giving a persistent perched water-table and slow tree growth. An analysis of further soil samples taken from (*a*) level ground, (*b*) hollows, and (*c*) hummocks, showed that over a 14-week period (*c*) were drier than (*a*) or (*b*), and dropped below saturation point 1–2 weeks before them. It appeared that growing conditions early in the season, when the soil was wet, were more favourable on (*c*) (10% drier than (*b*)) and were only slightly more adverse (3% drier than (*b*)) when the soil was dry.

4209. MAYCOCK, P. F., and CURTIS, J. T. **The phytosociology of boreal conifer-hardwood forests of the Great Lakes region.** *Ecol. Monogr.* 30 (1), 1960 (1–35). 73 refs.

Quantitative data on tree and herbaceous composition were collected for 110 upland forest stands throughout the Great Lakes region, and were analysed (*a*) on the basis of site moisture and (*b*) on the basis of spatial relationship of species to each other, estimated quantitatively. Results obtained by the methods supported one another and gave strong evidence of the continuous nature of the forests of the region.

4210. WEAVER, J. E. **Flood plain vegetation of the central Missouri valley, and contacts of woodland with prairie.** *Ecol. Monogr.* 30 (1), 1960 (37–64). 17 refs.

A long-term study of the origin and development of streams in the prairie (where most of the precipitation is absorbed by the deep soil) and of the woodland vegetation that often borders them.

4211. ALLER, A. R. **The composition of the Lake McDonald Forest, Glacier National Park.** *Ecology* 41 (1), 1960 (29–33). 14 refs.

A study was made of the composition of a *Thuja plicata/Tsuga heterophylla* forest on two areas between 3200 and 4200 ft., one undisturbed and the other severely burnt in 1929. Lists of species and their frequencies are given. On the burnt area *Pinus contorta*, *Populus trichocarpa* and *P. tremuloides* predominated.

4212. RICHARDS, L. G. **Forest densities, ground cover, and slopes in the snow zone of the Sierra Nevada west-side.** *Tech. Pap. Pacif. Sthwest. For. Range Exp. Sta.* No. 40, 1960. pp. 21. 2 refs.

Presents data obtained by intensive study of maps and aerial photographs from a sample of 331 40-acre plots at or above 5000 ft. on the west side of the Sierra Nevada, California.

4213. KUNKEL, G. Allgemeine Aufzeichnungen über den Busch- und Waldtypus von Ocoa (Chile). **[General notes on the shrub and forest type of Ocoa (Chile).]** *Willdenowia, Berlin-Dahlem* 2 (2), 1959 (218–30). 13 refs. [G.] L.S.

Describes briefly the climate and vegetation of the Ocoa valley, lat. 33° S., near Calera, created a nature reserve chiefly on account of its stands of the now rare palm *Jubaea spectabilis*.

4214. ACOSTA SOLIS, M. Los manglares del Ecuador. **[The Mangroves of Ecuador.]** *Contribución, Instituto Ecuatoriano de Ciencias Naturales, Quito* No. 29, 1959. pp. 82 + 1 map. 17 refs. [Span.span.e.f.]

Presents information on Mangrove swamps in general, the distribution of Mangroves on the coast of Ecuador, botanical composition of the Mangrove swamps and neighbouring areas, the morphology of *Rhizophora mangle* and its points of distinction from *Avicennia nitida* and *Laguncularia racemosa*, natural regeneration of Mangroves and their effects on the soil, properties and use of *R. mangle*, and the chemical properties of the tannin. The economic importance of the Mangrove swamps of Ecuador, and particularly those of Esmeraldas, is discussed, and the results are given of some inventories, with economic data on and recommendations for exploitation. The text of the decree at present in force controlling the exploitation and export of Mangrove bark is included.

4215. HERBERT, D. A. **Tropical and sub-tropical rain forest in Australia.** *Aust. J. Sci.* 22 (7), 1960 (283–90). 22 refs. O.R.S.

A general account of tropical rain forest in Australia, including its structural pattern, epiphytes, distribution, freshwater and marine fringing areas, ecology, and climate, with an assessment of its broad biogeographical relationships.

2. SILVICULTURE

See also Nos. 4117, 4197, 5218.

4216. BORSET, O. **Silviculture of Aspen.** *Scot. For.* 14 (2), 1960 (68–80 + 2 photos).

Summarizes the results of Norwegian research aiming at producing high-quality Aspen (*Populus tremula*) for matchstock.

4217. ORTMANN, C. Die spezifischen, standortsgebundenen Betriebsarten der Weiden (*Salix* sp.). **[The management of Willow species in relation to site.]** *Forst u. Jagd* 10 (3), 1960 (109–12, 129–30). 30 refs. [G.]

Discusses, largely on the basis of German literature, the sites suitable for *Salix caprea*, *S. daphnoides*, *S. pentandra*, *S. alba*, *S. fragilis* and various Osier species, and the methods of management, establishment and utilization suitable for each. Most of them are recommended for coppice or pollarding systems producing fuelwood, pulpwood, tool handles etc., but *S. alba* also for timber and veneer. Their uses in advance plantings, spoil-mound afforestation, shelterbelts, or interplanting of Poplar plantations are discussed. [Cf. *F.A.* 21 No. 1486.]

4218. HUBERMAN, M. A. **Mangrove silviculture.** *Unasylva* 13 (4), 1959 (188–95). 47 refs.

A modified extract from *FAO For. & For. Prod. Stud.* No. 13 [see *F.A.* 21 No. 1619]. Deals with the occurrence and habitat of Mangrove forests; their composition, species succession, seed production, establishment and stand development; silvicultural practice; and suggestions for research.

22. Silvicultural Systems. Constitution and Composition of Stands; Forms of Stand

221. High Forest Systems

See also Nos. 3988, 4233, 4237, 4249, 4281, 4349, 4676, 4678.

4219. **Report of the sub-committee on silvicultural systems for lowland tropical rain forests.** [*Docum.*] *5th Sess. FAO Asia-Pacif. For. Comm., New Delhi 1960* No. *FAO/APFC* 60/10.*e*3, 1960. 13 items, separately paginated, each pp. 3–11. Limited distribution.

Summarizes replies to a questionnaire on regeneration, with data on climate and soils etc., areas involved, economic and utilization factors, ecology of the more important species, enumeration and survey techniques, treatments, costs, available funds, etc., and makes recommendations. The replies of Burma, Ceylon, Fiji, India (3), Malaya

N. Borneo, Papua and New Guinea, and the Philippines are appended.

4220. **[Preliminary results of investigations on types of principal fellings and regeneration of *Pinus yunnanensis* in Kwangsi province.]** *For. Sci., Peking* 1960 (1), (44–54). [Chin.russ.]

The low stand density combined with dense ground vegetation militates against natural regeneration in *P. yunnanensis* stands, and artificial regeneration must be the main means of reforesting felled areas. Under natural conditions, Oak tends to replace the Pine. At present, principal fellings are done by clear felling strips (up to 150 m. wide) leaving unfelled belts of trees between the strips. Further studies are needed to determine the optimum felling system. Under the present system, extraction roads should be made parallel to the unfelled belts.

4221. VÉZINA, P.-E. Recherches sur les conditions de lumière et de précipitations dans les forêts traitées par la coupe progressive par groupes. **[Light and precipitation in forests managed under the Swiss *Femelschlag* (irregular shelterwood) system.]** *Mitt. Schweiz. Anst. Forstl. Versuchsw.* 36 (2), 1960 (33–137). 90 refs. [F.f.g.it.e.]

A detailed study of illumination, radiation and interception in relation to composition and density of stands, both broadleaved and coniferous, in the instruction forest of the Eidgenössiche Technische Hochschule at Zurich, with special reference to the microclimate in gaps and the effect of relative illumination, radiation and precipitation (expressed in % of values in the open) on the growth and survival of a light-demanding and of a shade-tolerant species (Ash and Beech respectively), supplemented by controlled experiments on Ash. Light intensities, measured at breast height with the Austrian "Norma" photometer in 40-year-old Spruce stands, varied comparatively little with stand density and, even in overcast weather (when the *relative* intensities in the stands were greater than in sunny weather), did not exceed 5·7% of those in the open. Under suitable conditions, seedlings of Ash and Beech sprang up even under very dense shade, but none aged > 2 years were found at relative intensities of < 3%, and at < 4% Ash only just survived. Using a Bellani spherical pyranometer at 1·15 m. above ground, continuous cumulative measurements of radiation were made from April to Oct. at the borders of a typical, elliptical regeneration gap with diameters 2 to 3 times the height of surrounding trees. Relative radiation varied from ca. 50% on the N. to ca. 20% on the S. of the gap. Inside the stand, relative radiation values varied in much the same way as relative light intensities. The rainfall round the gap varied from 107·6% of that in the open at the E. end to 86·6% at the W. (the prevailing winds being westerly). An analysis of regeneration in the thicket stage showed that the reduction of stem numbers with age was faster for Ash than for Beech, and that the effect of relative radiation on height growth, density, and vigour was also much greater for Ash. Elongation of terminal shoots was related to calories received over a period, Ash again being more sensitive. In the greenhouse experiments with seedlings, a relative illumination of 45% produced greater lengths, dry weights of aerial parts and numbers of leaves than did either 88 or 27%, though total dry weight was greatest at 88%. At all degrees of illumination, greater moisture gave better growth. In experiments with 3-year-old plants at relative light intensities of 86, 50, 22 and 12% and two degrees of moisture in two soils, height growth was linearly related to light intensity, but the effect was less than that of soil type and moisture regime. The Swiss *Femelschlag* is considered a flexible tool for varying ecological conditions to promote the regeneration of the species desired. For Ash, a relative light intensity of 50% appeared adequate, and 30% at the early stages sufficient.

4222. ANDERSON, M. L. **Norway Spruce—Silver Fir—Beech mixed selection forest. Is it possible to reproduce this in Scotland?** *Scot. For.* 14 (2), 1960 (87–93).

An address to the Silvicultural Group of the R.S.F.S. (17 Oct. 1959).

4223. MLINŠEK, D. Untersuchungen über den Zustand und die Pflege der Bauernwälder in Pohorsko Podravje (Slowenien). **[The condition of farm forests in Pohorsko Podravje, Slovenia, and their treatment.]** *Promotionsarbeit, Eidgenössische Technische Hochschule, Zürich* No. 2843, 1959. pp. 84 + 1 map, 1 tbl. 55 refs. [G.g.e.sloven.]

Describes the farm forests—chiefly Spruce forests worked on a traditional selection system—in the Central and Southern Alps of N.E. Slovenia, and analyses their structure, composition, increment etc., on the basis of an official enumeration survey supplemented by increment studies using Klepac's *temps de passage* method [cf. *F.A.* 16 No. 2055]. In general, growing stock was rather poor in quantity and quality, with too high a proportion (60–70%) of small timber (< 30 cm. d.b.h.). Though c.a.i. rose with increasing growing stock, the correlation, especially for the better sites, was not close. For equal volumes of growing stock, c.a.i. increases with the proportion of small timber. The *temps de passage* for single stems reached a minimum (i.e. increment reached a maximum) at 60 cm. d.b.h., but the number of large stems was small. It is estimated that annual increment could be raised from the present 4–8 cu. m. to 8–12 cu. m./ha. by increasing the growing stock from the present 110–400 cu. m. to 350–500 cu. m./ha. coupled with careful tending, admixture of other species, and replacement of the single-tree selection system by a group selection system designed to provide a better diameter distribution. The author recommends cutting up to 70% of the annual increment and increasing the growing stock gradually.

226. Changes of Silvicultural System. Conversion (by System or Species)

4224. PENISTAN, M. J. **Forestry in the Belgian uplands.** *Forestry* 33 (1), 1960 (1–7 + 2 plates). 6 refs.

A brief general account of forestry in the region to be visited by the Society of Foresters of Great Britain. The account deals chiefly with the present conversion of coppice with standards to high mixed forest and the transformation of pure Spruce plantations to mixed forests. *From author's summary.*

4225. McCORMACK, M. L., and KORSTIAN, C. F. **Converting upland hardwoods by planting Pine in scattered clearcut patches.** *J. For.* 58 (5), 1960 (400–1). 2 refs.

Circular patches of (*a*) ½, (*b*) ¼, and (*c*) ⅛ acre were cleared in a mixed hardwood stand in the Duke Forest, N.C., and planted with 1 + 0 *Pinus taeda* seedlings at 6-ft. intervals round concentric circles 6 ft. apart. After 6 (in some (*c*) patches 4) growing seasons, height growth was satisfactory except in the 3 outer circles, where competition from trees and shrubs along the margins retarded growth and encouraged a tendency to lean inwards. In (*b*) and (*c*), therefore, growth was unsatisfactory beyond a radius of 14–20 ft. from the patch centres. It is concluded that patches should be $\geqslant$ ½ acre. Rapid hardwood invasion, which in some cases reduced survival despite cleaning, may require checking mechanically. It is calculated that 5–6 circular (*a*) patches would supply sufficient seed for the natural regeneration of a 10-acre area. As such conversion can be done gradually in slack periods and at a low initial cost, it might appeal to farm woodland owners.

228. Constitution and Composition of Stands; Choice of Species and Form of Mixture; Tree Classes; Forms of Stand

See also No. 4019.

4226. KOLPIKOV, O. M. Osobennosti uslovij formirovanija i rosta sosnovyh biogrupp na koncentrirovannyh vyrubkah. **[Features of the formation and growth of groups of Scots Pine on concentrated fellings.]** *Izv. Timirjazev. Sel'.-hoz. Akad., Moskva* 1960 (2), (191–200). 1 ref. [Russ.russ.e.] O.W.

Investigations were made near Sverdlovsk on the effect of stand density and age on the microclimatic conditions and increment of young natural stands and group plantings on clear-felled areas in the *Pinetum vacciniosum.* Light, air and soil temperatures, and r.h. were determined. It was concluded that the optimum densities at 10 and 20 years are respectively 10 and 2–4 trees per sq. m. Planting should be done at a rate of 10 plants/sq. m., which is sufficient to combat weeds and to avoid the need for tending. This density provides microclimatic conditions favourable for rapid growth towards the age of 10; denser planting results in slower growth at this age, while planting at 5 plants/sq. m. involves several tending operations in the first 2–3 years, with attendant expense.

4227. DELLA-BIANCA, L., and DILLS, R. E. **Some effects of stand density in a Red Pine plantation on soil moisture, soil temperature, and radial growth.** *J. For.* 58 (5), 1960 (373–7). 4 refs.

Compartments of 39-year *Pinus resinosa*, on a sandy, weakly developed podzol in N. Lower Michigan, were studied from February to August, residual b.a. after thinning being (*a*) 80, (*b*) 120, (*c*) 190 sq. ft./acre; an adjacent open field (*d*) was also studied. In (*a*), (*b*) and (*c*) during the growing season, more moisture was found near the soil surface, precipitation primarily affecting the top few inches. While this superficial moisture was rapidly used up during dry periods, the depletion rate at lower depths was relatively constant. The moisture content in (*c*), where snow cover lasted a week longer, was higher than in (*a*), (*b*) or (*d*) at all depths until mid-April, but subsequently became lower. Soil-moisture curves showed greatest differences (significant at levels from 1 to 20% for 13 of 18 weeks of the growing season) at 6 in. depth, but there was little variation at 18 or 36 in.; the differences between these three depths were significant only at the 10% level. The radial growth difference between compartments was significant (1% level) 2 and 3 years after thinning, increasing in response to heavier thinning. In (*a*) and (*b*), greater soil moisture at 6 in. depth, due to reduced root competition and crown interception, allowed radial growth to continue till late August, vs. mid-July for (*c*). Soil temperatures varied among (*a*), (*b*) and (*c*), but not significantly: these, however, differed significantly from (*d*).

4228. KAIRIŪKŠTIS, L. Medžių klasifikacija mišriuose eglės jaunuolynuose. **[Classification of trees in young stands of Spruce and broadleaved species.]** *Liet. Miškų Ūkio Moksl. Tyr. Inst. Darb.* No. 3, 1958 (7–38). 31 refs. [Lith.russ.]

Studies were made in order to determine the correct choice of trees when thinning young stands that have developed on clear-felled areas. Such stands have three storeys (I, II and III), and four tree classes were distinguished, according to tree development, as follows: A^1—trees developing very strongly, always in the top storey (I). These should be removed in thinnings, except where they occur in gaps. *A*—trees developing well, including Spruce in (I)–(III) and broadleaved species in (I). These trees should be retained, with the exception of undesirable species. *B*—trees developing weakly, including Spruce in (II)–(III) and broadleaved species in (I)–(II). Half of these broadleaved species should be removed. *C*—suppressed trees, in (III), which should be removed, except the Spruce.

4229. KAJRJUKŠTIS [KAIRIŪKŠTIS], L. Formirovanie elovo-listvennyh molodnjakov. **[The formation of young stands of Spruce and broadleaved species.]** Litovskij Naučno-Issledovatel'skij Institut Lesnogo Hozjajstva, Kaunas. 1959. pp. 245. 152 refs. [Russ.russ.] Price *Roubles* 4.5.

The background to the study is the problem of broadleaved species replacing Spruce on clearings and burns in the Spruce forests of Lithuania. Extensive investigations were made, mainly in mixed Spruce/broadleaved stands, 10–25 years old, in the five main Spruce forest types. Site conditions, stand structure and composition, tree growth and development, and thinning are discussed in some detail. A tree classification system is worked out [cf. preceding abstract], and suitable regimes of thinning to favour the Spruce determined.

4230. HUGHES, E. L. **Nine years of developments in a mature mixedwood stand, Green River, New Brunswick.** *For. Chron.* 36 (1), 1960 (6–9).

Growth data collected on 3 permanent 1-acre sample plots, established in a mixed stand in N.W. New Brunswick in 1947 and remeasured in 1956, indicate that: (1) growth capacity of the site may be as high as 79 cu. ft./acre/year; (2) Birch trees [not further specified] weakened by dieback do not provide much competition to conifers; (3) because of the mortality of Birch from dieback, the stand is evolving from a mature mixed-wood to an uneven-aged conifer stand. *From author's abstract.*

23. Regeneration and Formation of Stands

231. Natural Regeneration

See also Nos. 4164–5, 4186, 4214, 4219, 4221, 4256, 4394, 4470, 4613, 4771.

4231. GALLAGHER, L. U. **Scots Pine: a new approach at Windsor.** *Irish For.* 17 (1), 1960 (37–9).

[Cf. *F.A.* 17 No. 3797.] An account of the successful regeneration of Scots Pine on Bagshot sands, by direct sowing or natural seeding, after bulldozing.

4232. BRAATHE, P. Gjenvekstregistrering i Trøndelagsfylkene. **[Registration of regeneration in [N. and S.] Trøndelag.]** *Tidsskr. Skogbr.* 67 (1), 1960 (1–10). [Nor.]

Describes the methods used in a study of 108 plots, chiefly in state forests, in autumn 1959. Results show zero-square %, number of plants (advance growth and later regeneration), and their height and age, in relation to four ground-vegetation types, climatic zone (an outer zone lying nearer the coast and an inner zone), altitude, etc. Mean zero-square % at 10·7 years was 52·5; it showed little relationship to climatic zone, altitude, etc. Conditions for natural regeneration on (1) lichen, (2) *Calluna*, (3) *Vaccinium vitis-idaea*, and (4) *V. myrtillus* sites, in Trøndelag, are poor; at the time of felling, 24–31% of the area carried advance growth and this was increased by later regeneration to 46–48%. There was little difference in the number of plants present on the different sites (a total of 20–27 on ten 2 × 2-m. squares) but only Pine was present on (1), the % of Spruce increasing through (2) and (3) to 85% on (4). Mean height (based on the tallest plant on each of 10 squares) on areas 8–12 years old was 43 cm. on (2), 54 on (3) and 81 on (4). Comparison with production figures for Spruce with sparse regeneration suggests that with a zero-square % of 52·5, yield on (4) will be at most 80% of yield-table figures. Yields for (1), (2) and (3) are less predictable, because corresponding figures for sparse Pine regeneration are not available. The results are compared with those of an earlier survey [see *F.A.* 19 No. 246] in some of the same districts.

4233. METREVELI, P. A. O rubkah v temnohvojnyh lesah Gruzinskoj SSR. **[Fellings in the Spruce/Fir forests of the Georgian SSR.]** *Lesn. Ž., Arhangel'sk* 2 (1), 1959 (57–64). [Russ.]

Describes the eight main forest types, and tabulates the amounts of *Abies nordmanniana* and *Picea orientalis* regeneration in each, for different degrees of canopy closure of the adult stand, and the amounts found in gaps and clearings of various sizes. From these and other observations it is concluded that, in *Festuca*-type stands on steep slopes, in stands of subalpine types, and in those with an evergreen shrub layer, selection fellings should be the rule. In mossy stands, and stands with a *Sanicula*/*Asperula* ground cover, shelterwood fellings with a regeneration period of 20–35 years are advised, or group-selection fellings with a regeneration period of 30–60 years. Data are also given on the age structure and b.a. of the stands.

4234. IVANENKO, B. I. Gornye lesa Severnogo Kavkaza i ih značenie dlja sel'skogo hozjajstva. **[Montane forests of the N. Caucasus and their importance for agriculture.]** *Vestn. sel'.-hoz. Nauki* 5 (3), 1960 (100–8). 11 refs. [Russ.e.g.f.] O.W.

[Cf. *F.A.* 20 No. 1636.] Discusses the harmful effects of clear felling and tractor skidding on natural regeneration, and on the protective and water-regulating functions of the forests, and outlines measures to check deterioration and to restore the montane forests.

4235. SOLODUHIN, E. D. Ob ėffektivnosti trelevki derev'ev s kronami i različnyh sposobov očistki vyrubok v kedrovo-širokolistvennyh lesah Primorskogo kraja. **[The effectiveness of full-tree skidding, and of different methods of clearing felling sites in the *Pinus koraiensis*/broadleaved forests of the Maritime Province.]** *Lesn. Ž., Arhangel'sk* 2 (1), 1959 (97–106). [Russ.russ.]

[Cf. *F.A.* 21 No. 1646.] Analyses the numbers and condition (living, damaged, dead) of trees left on the felling area, logging costs, natural regeneration, soil condition, and the numbers of heaps of slash or burned patches on the felling areas, for (*a*) tree-length, and (*b*) full-tree logging, and (1) burning the slash, (2) leaving it in heaps, and (3) spreading it evenly over the area. In these montane forests (*b*) was not economic. From the silvicultural aspects (regeneration and erosion danger) there was little to choose between (*a*) and (*b*). It was just as essential to clear the felling site after (*b*) as after (*a*). Methods (2) and (3) were economic only after (*a*). In many instances it was silviculturally sound practice not to burn the slash.

4236. CHANG, Y.-H. **[Natural regeneration of *Pinus massoniana* in Honan province.]** *For. Sci., Peking* 1960 (1), (14–23). [Chin.russ.]

P. massoniana, a light-demanding species, regenerates best on S. slopes. Seed is not usually dispersed for distances > 500 m., and the effective distance is $\not> 20$ m. Natural regeneration is good at stand density 0·1–0·3, and nil at densities $> 0{\cdot}7$. Ground cover of 10–25% does not impair regeneration, but a cover of $> 80\%$ prevents it. The optimum slope is 15–16°. A litter layer 1–3 cm. deep provides good conditions for regeneration, which is best along stand margins, roads, etc., and better in pure natural stands than in mixed. It is poor in mixtures with *Quercus* spp., or with *Liquidambar* sp. *P. massoniana* fruits abundantly for 10–20 years, and seed should be collected from trees

20–30 years old. Growth is much better in stands established by direct sowing than in natural stands.

4237. Ch'ien, K.-H. **[Observations on the regeneration of *Pinus tabulaeformis* on S. slopes of the Chin Ling Shan mountain range [Shensi province].]** *For. Sci., Peking* 1960 (2), (114–24). [Chin.russ.]

Natural regeneration under *P. tabulaeformis* is ca. 4300 plants/ha., of which *P. tabulaeformis* forms 37·2%, other conifers (*P. armandii*, *Tsuga* sp. etc.) 13·9%, and broadleaved species the rest. Regeneration of *P. tabulaeformis* was better in pure than in mixed stands, was best in stands of density 0·6–0·7, and better on slopes partly shaded than on N. and S. slopes. Slopes ⩾ 35° were not favourable for regeneration. The felling system recommended is by small clear fellings leaving strips of trees adjoining, and natural regeneration should be supplemented by planting.

4238. Leibundgut, H. Étude sur l'influence du charbon de bois sur la germination et le développement des semis d'épicéas, de pins et de mélèzes. **[The effect of charcoal on the germination and development of Spruce, Pine and Larch.]** *Schweiz. Z. Forstw.* 111 (3), 1960 (172–8). 1 ref. [F.g.]

In small-scale tests, finely powdered Beech charcoal, added to a seedbed of litter compost at 0·5 or 2 kg./sq. m., had no significant effect on germination and early seedling growth of the three species. It is concluded that the beneficial effect of burning on their regeneration is not related to the enrichment of the soil with charred matter, but in the first place, presumably, to the sterilization of the soil [cf. *F.A.* 12 No. 2918] and reduction of plant competition.

4239. Williams, D. E. **Prescribed burning for seedbed preparation in Jack Pine types.** *Pulp Paper Mag. Can.* 61 (4), 1960 (194 . . . 198). 6 refs. (*Woodl. Sect. Index Canad. Pulp Pap. Ass.* No. 1959 (*F*-2), 1960.)

Investigations in Manitoba and Saskatchewan showed that the burn must be made on a day when the humus layer has a moisture content ⩽ 20% as indicated by the drought index, and that only a few such days may occur in any one fire season. July and Aug. are the most promising months. The gang should be so organized that it can carry out the burn at short notice, but be gainfully employed while awaiting the proper conditions. Where there is heavy slash, a double burn is recommended—i.e. a hazard-reduction burn followed by a seedbed-preparation burn.

4240. Maple, W. R. **Rotary cutter prepares Pine seedbed for natural regeneration while clearing brush.** *Tree Plant. Notes* No. 40, 1960 (17–9).

Tests in N. Arkansas showed that tractor-drawn rotary brushcutters are effective in preparing *Pinus echinata* seedbeds where natural regeneration is difficult to obtain. Treatment with brushcutters after the 1957 bumper seed-crop gave a better catch of seedlings than prescribed burning or chemical control of hardwoods.

4241. Godman, R. M., and Krefting, L. W. **Factors important to Yellow Birch establishment in Upper Michigan.** *Ecology* 41 (1), 1960 (18–28). 27 refs.

Reports on a study of Yellow Birch (*Betula lutea*) regeneration and establishment begun in 1952 in Upper Michigan. Over a 20-acre area, all seed-bearing trees except Yellow Birch and a few White Pine and Hemlock were cut during winter 1952–53; the area was disked the following autumn. Undecomposed organic matter and undisturbed hardwood litter gave the fewest seedlings and the poorest growth of those that became established. Mineral soil mixed with partially decomposed organic matter proved the best seedbed. Scarification to expose mineral soil on 50% of the seedbed yielded the best stocking and growth. Surface soil moisture was a critical factor in germination and early establishment. Competition from shrubs following the heavy cut caused much mortality. Seedlings of Red Maple and other species were not strong competitors, though Red Maple sprouts tended to become dominant. Spring frosts caused frequent injuries but killed few Yellow Birch seedlings. The amount of sunlight influenced seedling development: 50% shade resulted in the best stem, leaf and root development and the greatest amount of seasonal height growth. A further cut after 3–5 years, to increase the amount of light, is recommended to maintain growth of established reproduction.

4242. Ebrecht, J. Buchennaturverjüngung aus dem Mastjahr 1958. **[Natural regeneration of Beech from the mast year 1958.]** *Allg. Forstzeitschr.* 15 (20), 1960 (289–91). [G.]

A survey of conditions on loess sites over greywacke or bunter sandstone in the N.W. Harz region. Partly because of spring frosts, regeneration was insufficient over 55% of the area. There was little correspondence between the regeneration map and the site maps (based largely on soil factors), but good correspondence with the vegetation-type map, with most variants of the *Fagetum dryopterisetosum*, usually on shaded slopes, better than those of the *Fagetum luzuletosum*, usually on sunny slopes. Soil wounding by scarification or skidding, after intensive thinning, improved regeneration. Marling, which had been done on certain plots in 1951, had no observable effects.

4243. **Pin Oak [*Quercus palustris*] acorn production and regeneration on flooded and unflooded areas.** Extr. from *Rep. Cent. St. For. Exp. Sta. 1959*, 1960 (14–5).

Acorns have been collected over 3 years from 900 seed traps on 36 ½-acre plots in 30-year-old Pin Oak stands, some of which were periodically flooded during the dormant season. The % of sound acorns was generally higher on the flooded area; continuous flooding for 3–4 months in the autumn and winter may have an adverse effect on pupae of attacking weevils. There was a definite relationship between the total number of acorns and the % that were sound: in the poorest seed-year only 8%, but in the best seed-year 73%, of all acorns were sound. When the crop exceeded 150,000/acre, however, the % of sound seed did not increase. Dormant-season flooding apparently greatly limited the occurrence of new seedlings. Seedlings originating in spring 1958 averaged 3000/acre in July 1959 on the normal area and only 56/acre on the flooded area. A likely cause of this is the consumption of large numbers of sound acorns by waterfowl on the flooded areas.

4244. STOJKO, S. M. Estestvennoe vozobnovlenie duba skal′nogo (*Quercus petraea* Liebl.) i čereščatogo (*Quercus robur* L.) v čistyh i smešannyh dubravah Zakarpat′ja. **[The natural regeneration of *Q. sessiliflora* and *Q. robur* in pure and mixed Oak forests in [Soviet] Transcarpathia.]** *Lesn. Ž., Arhangel′sk* 2 (1), 1959 (12–27). 29 refs. [Russ.]

Analyses, by number and age, regeneration of both the Oaks and of Beech in different forest districts, and also compares the rates of growth of Sessile Oak and Beech. The prospects for the introduction of Oak into pure Beech stands are promising, if the mixtures are properly tended. Natural regeneration of Oak in the pure and mixed forests of the region is good and, with correct shelterwood or group fellings, quite sufficient to ensure their perpetuation.

4245. RJABOVA, P. I. O dinamike travjanogo pokrova i samoseve drevesno-kustarnikovyh porod v Manyčkom leshoze Rostovskoj oblasti. **[Development of the herbaceous cover, and regeneration by seed of tree and shrub species in the Manych leskhoz, Rostov region.]** *Bot. Ž.* 45 (3), 1960 (441–3). 5 refs. [Russ.]

Investigations in coppice Ash and/or coppice Oak stands of various ages, some with *Acer platanoides*, developing on clear-felled areas. In Ash stands, which admitted more light, herbaceous growth was dense, and natural regeneration from seed was scarce. In Oak stands with Maple, where canopy closure was virtually complete, herbaceous growth was absent, and natural regeneration from seed abundant.

4246. NEČAEV, A. P. Faktory estestvennogo vozobnovlenija barhata amurskogo (*Phellodendron amurense* Rupr.). **[Factors in the natural regeneration of *P. amurense*.]** *Bot. Ž.* 45 (1), 1960 (77–84). 17 refs. [Russ.]

Discusses the ripening of the seed, and seed dispersal by birds, mammals, wind and water. It is concluded that birds are the main agents of dispersal, and that the prime requisite for reliable natural regeneration is moist, bare ground.

4247. GOWD, J. K. **Natural regeneration of *Eucalyptus*.** *Indian For.* 86 (4), 1960 (207–8).

A 3-acre plot of 17-year-old *E. citriodora* and an unidentified hybrid in Kamasandra State forest, near Thoppanahalli, Mysore, was felled in May 1958, leaving 16 standards. The trees had a mean height of 70 ft. and 2½ ft. g.b.h. In August the area was restocked by sowings and planting of various species, but in Sept. profuse natural regeneration of both Eucalypts appeared, together with coppice shoots. A year later the coppice shoots were 15–20 ft. and seedlings 4–6 ft. high. The return of Rs. 634/acre for the 17-year period was considered very good under local conditions.

4248. KHAN, M. I.-U.-R. **Shisham (*Dalbergia sissoo* Roxb.) natural root sucker regeneration versus artificial stump planting in Changa Manga irrigated forest plantation.** *Pakistan J. For.* 10 (1), 1960 (31–8). 2 refs.

Comparison of data obtained from line transects in two adjacent areas confirmed the superiority of natural root-sucker regeneration in number of plants per acre and both mean and maximum height, over expensive stump planting. It is concluded that irrigated plantations with a sufficient number of *D. sissoo* trees can be successfully regenerated, after final felling, by such natural regeneration.

4249. PETRAK, J. Regeneración natural y artificial del quebracho colorado (*Schinopsis balansae* Engl.). **[Natural and artificial regeneration of *S. balansae*.]** *Foll. téc. for. Adm. Nac. Bosques, B. Aires* No. 3, 1959. pp. 19 + 1 map. 4 refs. [Span.span.e.]

In order to investigate the causes of deficient natural regeneration in *S. balansae*, a study was made of growing stock, increment and yield in a national forest in the Chaco Territory. The results showed an almost complete absence of *S. balansae* in the lower age classes. Physiologically the species is not declining; when stands are poorly developed it is usually owing to lack of light. Grazing is one adverse factor, but the main cause of the lack of natural regeneration is the present irrational technique of exploitation by "selective" methods. The author strongly advocates the introduction of clear felling or shelterwood systems. No useful purpose would be served by replacing *S. balansae* by exotic tannin-producing species. A plan is proposed for growing it in combination with cotton. *From author's summary.*

232. Artificial Regeneration

See also Nos. 4124–5, 4220, 4249.

4250. Memoria 1958. **[Report [on Poplars] for 1958.]** *Mem. Com. Nac. Chopo, Madrid* 1958. pp. 163 + 4 maps. 4 refs. [Span.]

[Cf. *F.A.* 21 No. 2608.] Reports on work done during 1958, the present situation, and plans for 1959, and gives individual data on work in 22 provinces.

4251. Memoria 1958. **[Report [on Eucalypts] for 1958.]** *Mem. Com. Nac. Eucalipto, Madrid* 1958. pp. 110 + 2 maps, 7 photos, 2 tbls., 4 gphs. 6 refs. [Span.]

[Cf. *F.A.* 21 No. 2606.] Reports on work carried out in 1958, the programme for 1959, the present situation and further possibilities in 28 provinces, and includes 6 papers given at the third session of the Working Party on *Eucalyptus* of the FAO Joint Sub-commission on Mediterranean Forest Problems.

232.1. Choice and Trial of Species, Races etc.

See also Nos. 4366, 4368–9, 4381, 4400, 4405.

4252. ÉRPERT, S. D. Opytnye drevesnye nasaždenija Džanybekskogo stacionara Instituta Lesa AN SSSR (k vesne 1956 g.). **[Trial stands of trees at the Dzhanybek Station of the U.S.S.R. Academy of**

Sciences Forestry Institute (to spring 1956).] *Trud. Inst. Les.* No. 38, 1958 (182–204). [Russ.]

Discusses five main types of trial, the earliest of which was started (ploughing virgin land) in 1951. These are: plantings on soils of the solonetz complex (1) within, and (2) outside, the Chapaevsk-Vladimirovka State Shelterbelt, (3) plantings on the dark soils of the great depressions, (4) nest sowings of Oak, and (5) amenity plantings in and around the Station itself. The investigations cover the effect of fertilizers, depth and density of sowing, species, provenance, spacing, mixtures, snow-retaining capacity of belts, etc. No results are given.

4253. Chao, T.-C., and Ch'ên, C.-Y. **[Dividing Sinkiang into regions for forest improvement, and choice of main tree and shrub species for each region.]** *For. Sci., Peking* 1960 (2), (94–105). [Chin.russ.]

Distinguishes 13 regions, describing in a table the climate, vegetation, etc. of each, and lists in another table 66 tree and shrub species indicating the zone(s) for which they are suitable.

232.11. Species Trials, including Forest Gardens, Trials of Exotics etc.

See also Nos. 4409, 5177–8, 5192.

4254. **Report of the sub-committee on *Pinus* and *Eucalyptus*.** [*Docum.*] *5th Sess. FAO Asia-Pacif. For. Comm., New Delhi 1960* No. *FAO/APFC* 60/0.*e*1/2, 1960. pp. 5 + 22. Limited distribution.

Summarizes replies to two questionnaires on distribution and importance of species, ecological requirements, establishment techniques, etc., with a table showing the success of Eucalypt trials in Papua and New Guinea, Hong Kong, India, Korea, Malaya, and Thailand.

4255. Scott, C. W. **Radiata Pine as an exotic.** *Unasylva* 14 (1), 1960 (6–16). 28 refs.

A condensation of a chapter from a forthcoming FAO publication on *Pinus radiata*. It summarizes the experience in New Zealand, Chile, Australia, Spain, and the Union of South Africa.

4256. Nedkvitne, K. Innførde bartrearter som sår seg på Vestlandet. **[Introduced species of conifers that are spreading by self-sowing in Vestland.]** *Tidsskr. Skogbr.* 68 (1), 1960 (29–33). 12 refs. [Nor.nor.]

Brief notes on 25 species, also indicating where there has been crossing between related species.

4257. Tomanek, J. Ocena dotychczasowych wyników aklimatyzacji jodły syberyjskiej w arboretum Lasów Doświadczalnych SGGW w Rogowie. **[Assessment of the acclimatization of *Abies sibirica* in the Rogów Arboretum.]** *Sylwan* 104 (2), 1960 (17–40). 14 refs. [Pol.russ.e.]

The stand, established in the arboretum in 1929, now contains 716 trees (Ural provenance) on 0·18 ha. Climatic and soil conditions at Rogów differ considerably from those in the Fir's natural range, but the biological characteristics, growth rate and health of the stand are good. Dominants 27 years old averaged 13·5 m. high and 13 cm. in d.b.h. Fruiting has begun (10 trees in 1957). Volume increment corresponds to that of *A. alba* on site class II–III, and c.a.i. shows no sign of falling off. *A. sibirica* has proved resistant to late spring frosts in years when *A. alba* was seriously affected. It is too early for definite conclusions, but an extension of the trials, especially outside the range of *A. alba*, seems most desirable.

4258. Valk, U. Eestisse introdutseeritud kuused. **[Spruces introduced into Estonia.]** *Eesti NSV Teaduste Akadeemia Toimetised, Tallinn* (*Bioloogiline Seeria*) 1960 (1), (60–5 + 4 photos). 10 refs. [Est.russ.e.*russ.e.*] W.A.H.

Tabulates, in the English summary, data on the frequency, growth, frost resistance, cone production, and suitable uses in Estonia, of (1) *Picea obovata*, (2) *P.* [*obovata* var.] *fennica*, (3) *P. schrenkiana*, (4) *P. glauca*, (5) *P. engelmannii*, (6) *P. pungens*, (7) *P. glehnii*, (8) *P. rubens*, (9) *P. mariana*, (10) *P. orientalis*, (11) *P. omorika*, (12) *P. sitchensis* and (13) *P. jezoensis*. Growth of (1), (4), (5), (6) and (11) is good, while further studies are needed on (3), (7), (8), (10), (12) and (13).

4259. Burgos, J. C. El clima de las sequoias y la posibilidad climática de su cultivo en la Argentina. **[The climate of the Sequoias and the climatic possibility of their cultivation in Argentina.]** *Rev. for. argent.* 4 (1), 1960 (3–10). 7 refs. [Span.]

Climatic data from the areas of *Sequoia sempervirens* and *S. gigantea* in California were collected with particular regard to temperature and water regime and, on this basis, regions of Argentina were selected as being suitable for their cultivation. For *S. sempervirens* 4 zones and for *S. gigantea* 3 zones appear to have a suitable climate. For each of the species there exists one region where it could be grown without irrigation.

4260. Pedro Veillon, J. Bases económicas y ecológicas para la introducción de coníferas tropicales centroamericanas en Venezuela. **[Economic and ecological basis for the introduction of Central American tropical conifers into Venezuela.]** *Bol. Inst. For. Latino Amer., Mérida* No. 5, 1960 ([v–vi], 47–94). 24 refs. [Span.e.]

Discusses the present situation in production and consumption of forest products in Venezuela, and the possibilities of increasing home production. A promising solution is the creation of artificial forests in accessible areas by the introduction of species from other tropical zones of the Americas. A comparative study is made of the native ecological conditions of some Central American conifers, with particular reference to climate, and those of some potential areas of afforestation in Venezuela. The Venezuelan areas are listed, with details of their climate and with recommended species from similar climatic zones. Brief suggestions are also made for the establishment of such exotic plantations in Venezuela.

4261. Garavel, L. Le noyer noir d'Amérique (*J. nigra* L.). **[*Juglans nigra*.]** *Rev. for. franç.* 12 (6), 1960 (362–73). 4 refs. [F.]

A short account of the silvicultural characters and economic value of the species, its acclimatization in France, and notes on 3 plantations near Strasbourg.

4262. MOONEY, O. V. **The development of the Eucalypts in Irish conditions.** *Irish For.* 17 (1), 1960 (3–20). 9 refs.

Records the increment and yield of measurable stands and single trees that have survived from the plantings of numerous Eucalypt species in Ireland, and draws attention to observed silvicultural characters and the results of limited utilization studies.

4263. BORGO, G. Notas preliminares sobre la introducción experimental del género *Eucalyptus* a la Huasteca Potosina. **[Preliminary notes on the experimental introduction of *Eucalyptus* spp. to Huasteca Potosina [Mexico].]** *Chapingo, México* 12 (75), 1959 (299–307). [Span.]

The full text of a lecture [see *F.A.* 21 No. 361].

4264. CARRERAS, A. DE LAS. Observaciones sobre el comportamiento de *Eucalyptus cinerea* en la región pampeana. **[The behaviour of *E. cinerea* in the Pampas region.]** *Rev. for. argent.* 4 (2), 1960 (43–6). 3 refs. [Span.]

A review of the silvicultural characters and growth habit of this species suggests that it is suitable for western Buenos Aires, the eastern part of the Pampas Territory and southern Córdoba, particularly by virtue of its resistance to low temperature, drought, and attack by ants. There are few data on its growth in this region, but measurements in a plot near Buenos Aires of 1756 trees/ha. at 8 years of age showed a m.a.i. of 23 cu. m./ha. It is suggested that this would be a suitable tree for farm and ornamental woodlands and shelterbelts.

4265. ELENA, U. El crecimiento de *Eucalyptus camaldulensis* y *E. tereticornis* en el norte de la provincia de Santa Fé, Argentina. **[Growth of *E. rostrata* and *E. tereticornis* in the north of the province of Santa Fé, Argentina.]** *Rev. for. argent.* 4 (2), 1960 (55–60). [Span.]

Preliminary data from surveys of stand constitution made in sample plots in two plantations: (1) *Eucalyptus rostrata*, 7 years old, ca. 4 ha., initially spaced at 2·5 × 2·5 m.; (2) *E. tereticornis*, 6 years old, ca. 3 ha., initially spaced at 3 × 3 m.

4266. AHMED, K. J. **Cinchona and possibility of its introduction in the forests of East Pakistan.** *Pakistan J. For.* 10 (1), 1960 (39–45). 7 refs.

Cinchona succirubra and *C. ledgeriana* were introduced experimentally in the cool Bamboo forests of the Kassalong forest reserve in 1948. *C. succirubra* has done well and the total alkaloid content, as well as the quinine content, of the bark has proved satisfactory. *C. ledgeriana* is not suited to this region.

4267. MAHEUT, J., and DOMMERGUES, Y. Les teckeraies de Casamance: capacité de production des peuplements caractéristiques biologiques et maintien du potentiel productif des sols. **[The Teak plantations of Casamance [, Senegal]: yield and biological characteristics of the stands, and maintenance of soil fertility.]** *Bois For. Trop.* No. 70, 1960 (25–42). 22 refs. [F.e.span.]

After a brief historical account of the plantations, the authors give the results of enumeration surveys made in several plantations. Yields vary between 10 and 12 cu. m./ha./year. The second part of the study deals with Teak litter and the influence of Teak stands on soil evolution, and measures necessary for the maintenance of soil fertility. Teak is an exacting species; its litter decomposes rapidly and at the same time inhibits N-mineralization. Measures suggested for the prevention of soil deterioration include the application of mineral fertilizers, and the introduction of less exacting species either in admixture or as an understorey.

4268. NELSON, R. E. **Silk-Oak in Hawaii—pest or potential timber?** *Misc. Pap. Pacif. Sthwest. For. Range Exp. Sta.* No. 47, 1960. pp. 5. 7 refs.

Considered a range weed by cattle ranchers, the Silk Oak (*Grevillea robusta*) has shown that it can grow rapidly and produce good timber in Hawaii. Its wider use as a timber tree is recommended, particularly on sites unsuitable for other purposes, since Hawaii has few native timber species of any value.

232.12. Races and Provenance Trials

4269. LANGLET, O. Användningen av skogsvårdsstyrelsernas lagerhållna granprovenienser. **[Use of the Forestry Board's stock of Spruce provenances.]** *Skogen* 47 (8), 1960 (175–6). [Sw.]

Gives very brief notes on the properties, especially frost hardiness, of Swedish, Danish, German, Austrian, Czech and Polish provenances available in Sweden, with recommendations on their use.

4270. JENSEN, R. A., SCHANTZ-HANSEN, T., and RUDOLF, P. O. **A study of Jack Pine seed source in the Lake States.** *Minn. For. Note* No. 88, 1960. pp. 2. 1 ref.

Gives mean height and % survival after 5 field growing seasons for *Pinus banksiana* seedlings in 6 Minnesota plantations. The seedlings were of 29 provenances as part of large-scale seed-source trials in the Lake States.

4271. BETHUNE, J. E., and ROTH, E. R. **Source of seed affects growth of Longleaf Pine. Fifth year results.** *Res. Note Stheast. For. Exp. Sta.* No. 146, 1960. pp. 2. 1 ref.

Significant differences in height growth, time in grass stage, forking, and resistance to *Scirrhia acicola* were found between 6 provenances planted as part of the Southwide Pine Seed Source Study [cf. *F.A.* 21 No. 2752]. No correlation with longitude was found.

4272. BETHUNE, J. E., and ROTH, E. R. **Fifth year results of Loblolly Pine seed source planting in Georgia.** *Res. Note Stheast. For. Exp. Sta.* No. 145, 1960. pp. 2. 3 refs.

Loblolly Pines from 9 locations in seven states, planted as part of the Southwide Pine Seed Source Study showed highly significant differences in height growth, which were positively related to mean annual temperature zones, and in susceptibility to

Cronartium fusiforme (not related to latitude). All provenances were heavily infested by *Rhyacionia frustrana*.

4273. GODDARD, R. E., and BROWN, C. L. **Growth of drought resistant Loblolly Pines.** *Res. Note Tex. For. Serv.* No. 23, 1959. pp. 7. 1 ref.

Preliminary results of provenance trials of *Pinus taeda* in E. Texas showed consistently better survival in plants from seed of the drier, western provenances [see *F.A.* 17 No. 1461]. Examination of test plots after 6–7 years showed that growth and stem form of most of these western provenances were as good as, or better than, E. Texas and Louisiana sources on these sites.

4274. TROEGER, R. Kiefernprovenienzversuche. I. Teil. Der grosse Kiefernprovenienzversuch im südwürttembergischen Forstbezirk Schussenried. II. Teil. Ergebnisse der in den Jahren 1927 bis 1936 in Württemberg angelegten Kiefernprovenienzversuche. III. Teil. Versuche mit Herkünften aus Württemberg. **[Scots Pine provenance trials. I. The large-scale trial in the S. Württemberg forest district of Schussenried. II. The trials established in Württemberg from 1927 to 1936. III. Trials with Württemberg provenances.]** *Allg. Forst- u. Jagdztg.* 131 (3; 4), 1960 (49–59; 81–93). 24 refs. [G.g.e.]

Part I covers a 1950 evaluation of one of 12 localities of the Eberswalde trials established in 1936–37 by W. Schmidt with 50 German provenances [cf. *F.A.* 16 Nos. 1618, 3954]; Part II, 7 trials with 9 Württemberg and 11 other German provenances evaluated between 1949 and 1958; and Part III, trials in 5 localities established in 1951 with 10 provenances, evaluated in 1958. Results largely confirm earlier findings on the existence and characters of local races, with E. Prussian and Upper Schwarzwald provenances among the best for stem form and fine branching habit. The latter, however, was rather a slow grower, possibly because of high susceptibility to *Lophodermium pinastri*. *From author's summary.*

232.13. Trials of Hybrids and Other Products of Tree Breeding

See also Nos. 4511–2, 4597.

4275. ELSNER, F. Ergebnisse der bayerischen Pappelsorten-Probeanbauten 1951. **[Results of the Bavarian Poplar variety trials, 1951.]** *Holz-Zbl.* 86 (49), 1960 (700–2). [G.g.]

Discusses three evaluations, in 1953, 1955 and 1959, of 9 varieties on 43 sites [cf. *F.A.* 18 No. 333] with graphs showing height and diameter growth by 12 site groups for each of the 9 varieties tested. Differences increased with time, and those between sites were greater than those between varieties. The 5 best sites were found in the Danube and Isar flood-plains, and on sites with low groundwater in the Franconian Jura. On the sites in the S. Bavarian flood-plains, where differences were most marked, *P.* × "Bachelieri" was first in height, with *P.* × *brabantica* first in diam. and second in height. In the Jura *P.* × *gelrica* had the greatest diam. growth; this variety was also best in the cold climate of the Fichtelgebirge. Varieties of the *P.* × *robusta* group, including *P.* × "Bachelieri" and *P.* × *vernirubens*, suffered considerably from *Dothichiza populea*.

4276. GEORGIEV, Ž. O produktivnosti topolej v lesah Bolgarii. **[Yields of Poplars in Bulgaria.]** *Vestn. sel'.-hoz. Nauki* 5 (3), 1960 (124–6). [Russ. e.g.f.] O.W.

Tabulates data on standing volume and volume c.a.i. for some plantations of *Populus* × *regenerata*, *P.* × *marilandica* and *P.* × *serotina* at various ages and on various sites in Bulgaria.

232.2. Preparatory Work. Auxiliary Measures

See also Nos. 4238–9, 4351, 4363, 4371, 4379, 4433–4, 4450.

4277. HOPKINS, H. G., and ANDERSON, L. N. **The Marden Brush Cutter for slash disposal and ground preparation.** *J. For.* 58 (5), 1960 (377–9).

A Marden Brush Cutter, pulled by a D-8 tractor, successfully treated *Pinus resinosa* slash on a clear-felled area at Rogne River National Forest, Oregon. Results were less favourable when it was used to prepare a brush field with a sedge ground-cover for planting. Cost of treatment varied from $15/acre for single working of the brush field to ca. $36/acre for double-working the slash area. Retention of humus and potential humus on the site is a major advantage of this type of treatment.

4278. KOWALIŃSKI, S., and KOLLENDER-SZYCH, A. Wpływ użytkowania gleb na zmiane ich właściwości morfologicznych i fizyko-chemicznych. **[The effect of cultivation on the morphological and physico-chemical properties of soil.]** *Zeszyty Naukowe Wyższej Szkoły Rolniczej, Wrocław* No. 7, 1959 (57–67). [Pol.e.g.] From *abstr.* in *Soils & Fertil.* 23 (2), 1960 No. 730.

Investigation of three soil profiles on adjacent sites showed a reversion of the process of podzolization to development into a brown soil under the influence of ploughing and cultivation. Podzolization continued in soil under forest, the profile under conifers showing a more distinct eluvial horizon and lower degree of saturation than that under deciduous trees.

4279. SETH, S. K. **Soil working techniques in the dry zone [of India] in relation to rainfall and soil types.** *Indian For.* 86 (5), 1960 (241–73). 1 ref.

Following a classification of the dry-zone into rainfall types, dry-zone soils are classified according to rainfall, topography, parent rock, and profile; suitable methods of cultivation (illustrated diagrammatically) are recommended for each class. [Cf. *F.A.* 21 No. 3963.]

232.3. Seed, Nursery Practice, Direct Sowing

232.31. Seed

232.311. Seed Production (Seed Years, Seed Crops; Seed Orchards and Methods of Inducing Seed Production)

See also Nos. 3950, 4053, 4162, 4165, 4243.

4280. Bergman, F. Något om frömognad och fröbeskaffenhet hos tallen i Norrland. **[Maturity and quality of Pine seed in N. Sweden.]** *Skogen* 47 (11), 1960 (223–4). 8 refs. [Sw.]

Discusses the work of various Scandinavian writers, and presents data for 1950–59 showing that a good correlation exists between the mean germination % of seed from lat. 64° to 65°59′, alt. 300–399 m., and the sum of 'growth units' [see *F.A.* 14 No. 3177] in June–September; ca. 330 growth units are needed to ripen seed enough to give 90% germination.

4281. **Acorn production studies in Iowa.** *Extr.* from *Rep. Cent. St. For. Exp. Sta. 1959*, 1960 (15–6).

A 60% increase in numbers of White Oak acorns resulted from a shelterwood-type felling applied 2 years previously. Yields averaged 265,000/acre vs. 159,000 on uncut plots. Two types of girdling were tested, but neither increased acorn yield, though acorns on girdled trees were smaller and began dropping earlier.

4282. **The influence of crown pruning on production and distribution of cones on Loblolly Pine.** *Circ. Tex. For. Serv.* No. 62, 1959 (12).

A study was initiated in July 1958, in which 20 trees of cone-bearing age were treated in each of the following ways: (*a*) upper ½ of crown removed, (*b*) lower ½ of crown removed, (*c*) last 2 years' growth removed from all leaders, and (*d*) untreated controls. Preliminary results in the following spring indicated that (*a*) stimulates flowering on the lower branches, (*b*) stimulates flowering in the upper branches, and (*c*) had no effect on total cone production, but may have stimulated lateral branches to produce cones they would not normally have produced.

4283. Klaehn, F. U. **Seed orchard classification.** *J. For.* 58 (5), 1960 (355–60). 49 refs.

Reviews European and N. American literature and practice, and suggests a system of classifying seed orchards according to purpose and method of pollination. For each of the 12 resultant classes the age limits for ortets, number of clones to be used, clonal arrangement, and minimum distance of isolation from other trees are tabulated. [Cf. *F.A.* 20 No. 3058.]

4284. Opitz, H. Pokusny semenný sad limby v Javorine. **[An experimental *Pinus cembra* seed orchard at Javorina.]** *Sborn. Prác Tatr. Nár. Parku, Tatr. Lomnica* No. 3, 1959 (127–53). 33 refs. [Slovak.russ.e.g.]

The orchard is at 1050 m. alt. and faces S.W. Trials in 1956–58 showed that grafting could be done successfully in the open in both spring and summer. The results of grafting trials on some other tree species are also discussed briefly.

4285. Bouvarel, P. Les vieux pins laricio greffés de la forêt de Fontainebleau. **[The old Corsican Pine grafts of the forest of Fontainebleau.]** *Silvae Genet.* 9 (2), 1960 (41–4). [F.f.e.g.]

A large-scale experiment in grafting Corsican on to Scots Pine was initiated in 1820 in the forests of Fontainebleau, for the purpose of seed production. Of the original 100,000 Pines only ca. 100 remain, most of them of remarkable dimensions and form. Some data are presented on their characteristics.

4286. Graves, A. H. **Hastening flowering in a Chestnut seedling.** *Rep. Nth. Nut Growers Ass.* No. 49, 1958 (90–4). 6 refs.

Describes successful induction of flowering in a 7-year-old tree of *Castanea henryi* by removing a ring of bark 2 in. wide, and immediately replacing it in an inverted position. [Cf. *F.A.* 17 No. 3658.]

232.312. Seed Collection, Extraction and Grading (including Seed Weight)

See also Nos. 4165, 4295.

4287. Winjum, J. K., and Johnson, N. E. **A modified-knife cone cutter for Douglas-Fir seed studies.** *J. For.* 58 (6), 1960 (487–8). 3 refs.

Gives specifications for a device that has been successfully tested over two years with a wide variety of cones. A butcher's knife, pivoting from a short arm welded to its tip, slices forwards and downwards on to a cone placed in a groove in a supporting cutting block.

4288. Jovanović, M. L'influence de la grosseur des graines du pin noir (*Pinus nigra* Arn.) sur la germination et le développement des semis pendant la première année de végétation. **[The influence of *P. nigra* seed size on germination and seedling development during the first growing season.]** *Rev. for. franç.* 12 (5), 1960 (301–8). 13 refs. [F.]

In tests in Jugoslavia, seeds from each of 15 *P. nigra* trees were divided visually into two classes—(*a*) large or (*b*) small, control samples were taken, and weight per 1000 was calculated. It was found that size of seed had no influence on germination % under laboratory conditions, but the % in the nursery was higher for (*a*) than for (*b*). At the end of the first growing season, and with a mean weight advantage of 51·7% over (*b*), (*a*) produced seedlings 41·5% heavier, 25·6% taller and with secondary roots 31·9% longer. A considerable variation was noted between seed-trees, (*b*) seed from some trees gave better results than (*a*) from others. [Cf. *F.A.* 19 No. 2917.]

232.314. Seed Purchase, Trade and Transport (including Seed Certification and Legislation for this Purpose)

4289. Tulstrup, N. P. **International trade in forest tree seed.** *Unasylva* 13 (4), 1959 (196–201).

Reviews the history of international trade in forest tree seed, assesses the volume of trade done to-day, and the importance of the seed trade in the establishment of exotics, and emphasizes the importance of a universally accepted seed-certification system.

4290. Stern, K. Über einen grundsätzlichen Unterschied der forstlichen Saat- und Pflanzgutgesetzgebung in der Schweiz und der Bundesrepublik Deutschland. **[A difference of principle between the**

Swiss and W. German laws on forest seed and planting stock.] *Schweiz. Z. Forstw.* 111 (3), 1960 (145–63). 11 refs. [G.]

The author, who regrets that the German law [cf. *F.A.* 19 No. 2918] does not, like the Swiss [cf. *F.A.* 18 No. 3949] provide for the obligatory use of local provenances, bases his arguments on modern Mendelian genetics, particularly population genetics and the concepts of co-adaptation and heterosis, and supports them by genetical analysis of heterotic effects (leaf deformities, dwarf growth, etc.) observed after crossing *Betula cordifolia* with *B. pubescens*, *B. verrucosa* with *B. pubescens*, and a Swedish with a N. German provenance of *B. verrucosa* [cf. *F.A.* 21 No. 123].

4291. **Forest tree seed certification in the United States: Report of a subcommittee of the Lake States Forest Tree Improvement Committee.** Consolidated Water Power and Paper Company, Wisconsin Rapids, Wisconsin. 1959. pp. 3.

At present only one state, Georgia, gives legal recognition to the genetic quality of tree seed. Michigan, the other state in which the forest tree seed trade is controlled, does not certify genetic quality. Again, neither origin nor genetic quality is considered in the informal control exercised in the West Coast States. It is recommended that the subcommittee prepare certification standards suitable for conditions in the Lake States.

232.315. Seed Storage and Treatment

See also Nos. 4555, 4598.

4292. **[Storage of *Araucaria klinkii* seed.]** *Extr.* from *Rep. Dep. For. Papua & N. Guinea 1957/58*, [1958?] (23).

It was found that cold, moist sealed storage at 38° F. extended the period of full viability from < 1 month to 12 months, and satisfactory viability to 18 months.

4293. **[Storage of *Araucaria klinkii* seed.]** *Extr.* from *Rep. Dep. For. Papua & N. Guinea 1958/59*, 1959 (25).

Both winged and de-winged seed stored under normal conditions were found to deteriorate at the same rate, the viability falling to 60% of the initial figure at 4 weeks and to nil at 10 weeks. Studies of storage at different temperatures and m.c.'s, still in progress, indicate that ca. 38° F. is the optimum temperature.

4294. **[Douglas-Fir seed studies.]** *Extr.* from *For. Res. Rep. Weyerhaeuser Co., Centralia, Wash. 1958*, 1959 (4).

Content of reducing sugar (r.s.) was found to be a good criterion of seed maturity. At $\leqslant 15$ mg./g., seed was mature and ready for immediate extraction. Storage in the cone reduced seed quality. Seed with r.s. contents < 25 and > 15 mg./g. could be after-ripened in the cone under moist conditions. When cones picked in July having seed with an r.s. content of 30 mg./g. were ripened artificially by 6 methods, 4 of which included fungicides, germination % rose from 27 to a mean of 51 for all treatments in two weeks, and thereafter declined, particularly in seed from cones stored in shaded bags. Dipping gave better protection against moulds than spraying.

4295. Privalov, G. F. Žiznesposobnost′ semjan berezy v processe ih sozrevanija i hranenija. **[The viability of Birch seed during ripening and storage.]** *Bot. Ž.* 45 (1), 1960 (149–51). 11 refs. [Russ.]

The viability, 1000-seed weight, and moisture content of full seeds collected from *Betula verrucosa*, *B. pubescens* and *B.p.* var. *rhombifolia* in the Moscow area were determined immediately after 10 dates of collection from 21 June to 16 Oct. 1951, and then in Oct. 1951, '52 and '54. The seeds were stored (initial moisture content 10–11%) in paper packets at room temperature. Germinative capacity was roughly the same for all the trees, but *B. verrucosa* had a somewhat higher germinative energy than *B. pubescens*. Some of the seeds remained viable for at least 3 seasons, the best results being with the later dates of collection (germinative capacity ca. 95% after 1 season and 30% after 3, for seed collected on 16 Oct.). Good but not excessive drying is necessary before storage; a delay of 12 days before drying caused a reduction of 32% in germinative capacity. Drying seed for 30 hr. (to 7·4% m.c.) at 45–50° C. lowered germinative capacity by only 2·3%. Seedlings from seeds collected and sown within a few days in July had the greatest height growth. *B. verrucosa* seedlings were taller but more slender than those of *B. pubescens*.

4296. **Nursery and garden works: *Shorea robusta* in the laterite zone (annual rainfall 45 inch).** *Extr.* from *Rep. For. Adm. W. Bengal 1954/55*, 1959 (30–1).

Stumps of 0·3 in. diam. with 9 in. of tap-root and ½ in. of shoot, planted in June, gave good results in the dry laterite zone of W. Bengal, where the monsoon starts a month after the seeding time of the species. Experiments in storage of the seed gave varied results; best results were obtained by storing winged seeds in a covered pit dug under shade in dry ground towards the end of May, when 85% of seeds were found to be viable after 3 weeks.

4297. Aiyadurai, S. G. **A note on the germination of Neem seeds (*Azadirachta indica* A. Juss.).** *Madras Agricultural Journal, Coimbatore* 46 (4), 1959 (127–30). 4 refs. L.S.

Describes experiments to prolong the viability of Neem seeds in order to obtain, if possible, seedlings about 3 months old for transplanting (July–August) at the rains. Ripe seed, collected June–July, depulped and dried in the sun for 3–5 days, lost their viability (greenhouse tests in sand) rapidly if stored under ordinary room conditions (28° C.). Storing at 0° killed them. Storing at controlled humidities of 25 and 50% in one year and 40 and 80% in the following, considerably retarded the fall in germination %, but by December this had reached nil in both years. Of two types of seed tested, the round type lost viability more rapidly than the oblong type under most test conditions.

4298. ORLOV, F. B., and TARABRIN, V. P. Vlijanie namačivanija semjan v vode na nabuhanie i na pojavlenie vshodov. **[The influence of [duration of] soaking in water on the swelling of seeds and on field germination.]** *Lesn. Ž., Arhangel'sk* 2 (1), 1959 (44–53). 15 refs. [Russ.russ.]

Seeds of *Pinus sylvestris*, *Picea abies*, and *Larix sukaczewii* (3 samples per species, 100 seeds per sample) were soaked in water at 18–20° C. for up to 50 hr., and were weighed every 5 hr. Pine seeds absorbed water most rapidly in the first 10 hr., and Larch and Spruce seeds in the first 25 hr. Highest field germination % for Pine was with seeds soaked 5 and 10 hr., for Spruce 10, 20 and 30 hr., and for Larch 40 hr. Soaking Pine and Spruce > 30 hr. reduced field germination. Soaking hastened germination in all three species, the first seedlings emerging 4–9 days earlier than those from unsoaked seed.

4299. LEHTO, T. V. **Stratifying Pine seeds in plastic bags.** *Amer. Nurserym.* 111 (7), 1960 (15).

In a preliminary experiment with Loblolly and Shortleaf Pines, seed was soaked in cold water for 8 hr., drained and placed in polyethylene bags tightly sealed with rubber bands, stored for 15 days in the cold room at 34–38° F. and then allowed to germinate in sand flats at 70–75°. Tabulated results showed that most seed germinated within 15 days. The method proved more economical, flexible and convenient than the cotton-bag/sphagnum-moss method of stratification.

4300. ALLEN, G. S. **Factors affecting the viability and germination behaviour of coniferous seed. IV. Stratification period and incubation temperature, *Pseudotsuga menziesii* (Mirb.) Franco.** *For. Chron.* 36 (1), 1960 (18–29). 11 refs.

[Cf. *F.A.* 20 No. 1704.] Douglas Fir seed from 10 geographic sources was stratified for periods of up to 150 days and incubated at 10, 15, 20, 25, and 30° C. The relatively rapid germination at 10° after the longer periods of stratification indicates advantages for nurseries subject to cold spring weather. The observed decrease of germination % (and apparent germinative capacity) after long periods of stratification of some lots suggests that long stratification may be used as a test of vigour or durability. Separation of Coastal from Interior seed lots, and further separation of these into broad classes, appears possible on the basis of germination behaviour at 10° or 15° after a specific period of stratification, e.g. 20 or 40 days. *From author's abstract.*

4301. DANILOVA, A. A. Vlijanie predposevnoj podgotovki semjan na ih gruntovuju vshožest'. **[The influence of seed pretreatment on field germination.]** *Lesn. Ž., Arhangel'sk* 2 (1), 1959 (54–6). 2 refs. [Russ.]

Field germination % of seeds of *Euonymus verrucosus*, *Tilia cordata*, *Acer platanoides*, *Fraxinus excelsior* and *Juglans mandshurica* increased with increasing period of stratification (from 3 to 6 months), but even after 6 months' stratification, the field germination % was less than for seed sown fresh. Seeds of *J. mandshurica* germinated well when immersed in water at an initial temperature of 75 or 100° C., allowed to soak for 24 hr., and then kept in moist sand at room temperature: after 30–40 days in sand, $> 42\%$ of the seeds were germinating.

4302. LJUBČENKO, V. M. Temperaturnyj režim stratifikacii semjan lipy melkolistnoj i bereskleta evropejskogo. **[Stratification temperatures for seeds of *Tilia cordata* and *Euonymus europaeus*.]** *Lesn. Hoz.* 12 (1), 1959 (32–4). [Russ.]

Reports results of stratification trials showing that *T. cordata* seeds germinated best if kept at 15° C. for 70 days, and then at 0° for 95, 110, or 140 days. *E. europaeus* seeds germinated best when stratified for 70 days at 15° and then at 5° for 95, 110, or 140 days; stratification at 15° for 90 days and then at 5° for 110 and 140 days also gave good results.

4303. LJUBČENKO, V. M. Prorastanie zarodyšej lipy i bereskleta v svjazi so stratifikaciej. **[The growth of embryos of *Tilia cordata* and *Euonymus europaeus* in relation to stratification.]** *Bot. Ž.* 45 (1), 1960 (144–8). 21 refs. [Russ.]

[Cf. *F.A.* 21 Nos. 391, 3029.] Excised embryos of *T. cordata* from seed stored dry (2 and 6 months), and from stratified seed (2 or 6 months at 15° C.; or 2 months at 15° and 4 at 0°), grew equally well. Growth of excised embryos of *E. europaeus* depended on the period of seed storage and on the method and duration of stratification; the embryos grew well only if taken from seeds subjected to temperatures of 0–5° for 30–90 days after the seed-coat had split during previous stratification at 15°.

4304. **Nursery and garden works: *Tectona grandis*.** *Extr.* from *Rep. For. Adm. W. Bengal 1954/55*, 1959 (31–2).

Experiments in pretreatment of Teak seed by soaking in pits has shown that maximum benefit was reached at the end of 2 weeks, after which further soaking had an adverse effect. Other experiments showed that best results were obtained by alternate soaking and drying for periods of 48 hours repeated ca. 6 times.

4305. LI, S.-J., and YANG, H.-J. **[Experiment on the rapid stratification of *Pinus koraiensis*.]** *For. Sci., Peking* 1960 (1), (1–7). [Chin.russ.]

The best method was to mix the seed with 2–3 times the amount of sand (at ca. 60% m.c.) and to keep it for 1 month at 25° C. and 2 months at 4°. Germination after 30 days totalled 75%, and field germination after 60 days 74·5%. Fungicidal seed coatings applied before stratification gave even better results; soaking for 24 hr. in solutions of 0·5% $CuSO_4$, 0·3% KBr and 3% H_2O_2 gave 79·5, 76·0 and 92·0% germination respectively, and 48 hr. in a 1% malt powder solution gave 90·0 vs. 75% for controls.

4306. GRIBKOV, V. V. Predposevnaja obrabotka mikroèlementami semjan hvojnyh porod. **[Treating seeds of coniferous species with trace elements before sowing.]** *Vestn. sel'.-hoz. Nauki, Moskva* 5 (4), 1960 (129–31). [Russ.] O.W.

Seeds of *Pinus sylvestris*, *Larix sibirica* and *Picea abies* were soaked for 18 hours in solutions of H_3BO_3, $ZnSO_4$, $CuSO_4$ and $KMnO_4$ at concentrations of 0·1, 0·5, 1, 1·5, 2 and 2·5 g./litre. The treatments had a positive effect on the growth of the seedlings. The dimensions of seedlings from *L. sibirica* seed treated with $KMnO_4$ (2·5 g./litre) and $CuSO_4$ (1 g./litre) are tabulated, and are significantly better than those of controls, e.g. the yields of standard seedlings were respectively 92 and 40% higher than with the controls.

4307. P'ÊNG, Y.-F. **[Preliminary investigations on the effect of seed dressings containing trace elements on the growth of seeds and seedlings of *Sassafras* [*tzumu*].]** *For. Sci., Peking* 1960 (2), (106–13). 18 refs. [Chin.russ.]

Of the 9 preparations tested, $CuSO_4$ was the most effective in increasing germinative energy and total germination.

232.318. Seed Testing. Germination Tests. Seed Quality

See also Nos. 4052, 4300.

4308. SCHELL, G. Die Abhängigkeit der Lebenskraft und der Pflanzengrösse von der Keimschnelligkeit. **[Relation of vigour and plant size to speed of germination.]** *Forstwiss. Cbl.* 79 (3/4), 1960 (105–26). 30 refs. [G.]

In Beech, Norway Spruce, Scots Pine, Silver Fir, European and Japanese Larch, Douglas Fir and *Pinus strobus*, the less the speed of germination (s.o.g.) of a seed in relation to others of the same lot, the less vigorous the seedling. No such connexion, however, was apparent in *Quercus robur* and *Q. borealis*. In all these species except *Q. borealis*, there was a relation between s.o.g. and increment in weight and in shoot height. These early differences tended to even out later, but the start gained by plants from quickly germinating seeds is so great that it should be utilized in practice. In Spruce, and probably in the other conifers too, there was a tendency for the effect of s.o.g. on plant size and growth to be masked by the influence of seed size, but seedling vitality (measured by survival) was clearly determined by s.o.g. No connexion was found between growth in later years and s.o.g., but s.o.g. could be used up to a point as an indicator in provenance trials. Certain individual trees always produce seed with a high or low s.o.g., and the latter should be rejected for propagation. In Beech there was no relation between s.o.g. and flushing date. The importance of the s.o.g. factor in raising nursery stock is emphasized.

232.32. Plant Rearing. Nursery Practice

See also No. 4353.

4309. ROTTY, R. **Methods and machines used in North American nurseries.** *Unasylva* 14 (1; 2), 1960 (17–38; 65–83).

In order to make this article useful for a wide range of nursery conditions, information is given on methods and machines applicable to several levels of mechanization; e.g. descriptions are given of equipment suited to large nurseries, moderate-sized ones, and those without self-powered equipment. Much of the material is taken from *Tree Planters' Notes*, and there are numerous illustrations.

232.321. Nursery Sites, including Factors affecting Selection of Sites for Nurseries

See also No. 4311.

4310. Szkółka w kształcie kolistym na terenie Świetokrzyskiego Parku Narodowego. **[A circular forest nursery in the Świetokrzyski National Park.]** *Las Polski* 34 (4), 1960 (17–8). [Pol.]

Describes and illustrates the design of a circular nursery of ca. 29 ares, made by felling and clearing a circular strip 19 m. wide in a Fir/Pine stand 85 years old, leaving standing a central "island" of forest 30 m. in diam. The seed and plant rows are arranged in concentric circles with radial access roads. The greatest advantage of this circular nursery design is the excellent light regimes it is able to provide for the various species of young plants grown.

232.322. Preparation and Treatment of Soil, including Maintenance of Fertility

See also Nos. 4343, 4553, 4716.

4311. MIKOLA, P. Tutkimuksia taimitarhamaasta ja sen vaikutuksesta taimien kehitykseen. **[Soil properties and seedling growth in Finnish forest nurseries.]** *Commun. Inst. For. Fenn.* 49 (2), 1957 (1959). pp. 78. 57 refs. [Fi.*e.*]

A study based partly on information obtained through questionnaires [cf. *F.A.* 20 No. 412] and partly on analyses of soil and plant samples from 24 representative nurseries. The object was to investigate (1) how soil properties vary, (2) how seedling growth and quality depend on different soil properties, (3) how nursery soils should be managed in Finland. (1) Mechanical composition, % organic matter, pH, nutrient and micro-element content were determined. (2) For each nursery a detailed survey is given, with the main characteristics of Pine and Spruce seedlings grown there. Good and poor seedlings were found on all soil types. The best correlation was between seedling growth and humus content. Soil acidity was less important, good seedlings growing within a range of pH 4·5–6·5. (3) Silt and clay content should not exceed 15·20%. Forest rather than agricultural soil is recommended, preferably stoneless and sandy. Humus content should be at least 3% organic carbon. For soil improvement and fertilizing, a balanced application of peat and compost between crops is recommended, with top dressing during the growing season.

4312. **Soil sterilization.** *Bull. Minist. Agric., Lond.* No. 22 (5th ed.) 1959. pp. v + 49 + 4 plates.

This account, entirely rewritten since the previous edition (1948) in the light of further developments in soil-steaming equipment and of advances in sterilization techniques, covers the following topics: (*a*) the effects of soil sterilization; (*b*) sterilization by chemicals; (*c*) soil treatment after sterilization; (*d*) lay-out of soil sheds. Details on steam properties, the flow of steam through mains and perforated pipes, and operation costs, are appended.

4313. INGESTAD, T., and MOLIN, N. **Soil disinfection and nutrient status of Spruce seedlings.**

Physiol. Plant., Copenhagen 13 (1), 1960 (90–103). 49 refs. [E.e.]

An investigation of "soil sickness" and the causes of growth stimulation after soil fumigation was carried out at two Swedish nurseries, (*a*) Sjögränd, and (*b*) Nässja. After fumigation with MeBr at (*a*) and formalin at (*b*), Spruce seed was sown. Some plots were fertilized with $(NH_4)_2SO_4$ or $NaNO_3$ at various rates. Growth measurements and needle analyses were made at the end of each of two growing seasons. It was found that soil fumigation significantly stimulated growth, particularly in combination with $(NH_4)_2SO_4$. Results of needle analyses indicated, however, that this stimulation could not be explained on the basis of changed nutrient status of the seedlings after fumigation. Damage to the roots by parasites was insufficient to explain the poor growth on untreated plots. The possibilities are discussed that the soil microflora, by means of its metabolic processes, exercises a direct or indirect effect on seedling growth, and that nutrient factors have a selective effect on the micro-organisms invading the soil after fumigation.

4314. **New material prevents disease: supplie nitrogen at same time**. *Extr.* from *Rep. Wis. Agric. Exp. Sta. 1958*, 1959 (14).

Pinus resinosa seedlings raised in sand inoculated with damping-off fungi suffered 90–100% mortality after 7 weeks; only 3% of seedlings raised in the same sand, but with added urea-formaldehyde, died. In further tests with uninfected sand it was found that urea-formaldehyde stimulated seedling growth better than an equivalent amount of N given in the form of NH_4NO_3.

4315. MATSUI, M. **The effect of sawdust compost on the growth of Monterey Pine seedlings raised on biocide-treated soils.** *Proceedings, First North American Forest Soils Conference, East Lansing 1958*, [1959?] (150–2). 6 refs.

The addition of sawdust compost [cf. *F.A.* 20 No. 3815] counteracted the bad effects on *Pinus radiata* growth of thiosan, chlordane and allyl alcohol added to a sandy medium [cf. *F.A.* 19 No. 3102; 20 No. 4454]. Twenty lb./acre sufficed to raise weights and heights above those of controls at biocide rates of 120 lb., 10 lb., and 50 gal./acre respectively, while 40 lb. compost sufficed for three times these rates. The biocides adversely affected mycorrhizae and the uptake of bases and P, but not of N. The composts restored and increased mycorrhizal growth and base uptake, and greatly increased N uptake.

4316. **Sawdust compost helps detoxify soil.** *Extr.* from *Rep. Wis. Agric. Exp. Sta. 1958*, 1959 (15).

An experiment was made to ascertain whether composted sawdust can counteract the ill effects of repeated application of pesticides to nursery soils. *Pinus radiata* was sown in pots in sand treated with thiosan (at 120 lb./acre), chlordane (10 lb./acre) and allyl alcohol (50 gal./acre). Some pots (*a*) received no further treatment, while to others (*b*) there was added sawdust compost [species not stated] at the rate of 20–40 cu. yd./acre; some pots (*c*) received neither chemicals nor compost. Seedlings in (*a*) nearly all died. Survival in (*b*) pots was excellent and seedlings were nearly twice as high, with root systems double the size of those in (*c*).

4317. KISTENFEGER, J. Erfahrungen bei der Einführung von Motor-Kleinfräshacken in Forstpflanzgärten. **[Experience with the introduction of small motor cultivators in forest nurseries.]** *Forstarchiv* 31 (6), 1960 (99–100). [G.]

From experience with two 2·5-h.p. cultivators, the 'Terra' by Gutbrod, and the 'Baby' by Agria, suitable conditions for their use, work procedure, performance and costs are discussed. Details are also given for a mower attachment for use with the 'Terra'.

232.323. Sowing and Covering

See No. 4295.

232.324. Transplanting and Lining Out, including Grading of Seedlings

4 18. DICKSON, A., LEAF, A. L., and HOSNER, J. F. **Quality appraisal of White Spruce and White Pine seedling stock in nurseries.** *For. Chron.* 36 (1), 1960 (10–3). 7 refs.

Total seedling weight, shoot weight, and root weight in grams on an oven-dry basis, root-collar diam. in mm., and height in cm., were used to develop an integrated index of seedling quality, for use on a sampling basis, e.g. for assessing the relative quality of the nursery harvest in any given year.

4319. HEDEMANN-GADE, E. Omskolningsförsök med barrträdsplantor. **[Transplanting trials with conifer plants.]** *Skogen* 47 (10), 1960 (202–3, 207). 2 refs. [Sw.sw.]

Compares results of experiments in the 1920s on date of transplanting, with those of an experiment in 1958. Both for 1 + 0 Pine and, less markedly, for 2 + 0 Spruce the 1958 results confirmed that early transplanting (April–May rather than June–July) gives the largest plants in the year after transplanting. Pine should be planted within 6, and Spruce within 8, weeks after work in the nursery can start.

4320. STODDART, W. F. **One-man lining-out board.** *Scot. For.* 14 (2), 1960 (97–8).

Describes (with scale diagram) the construction and use of the board. In an established nursery, where the soil has been well worked, one man should be able to line out a minimum of 8000 seedlings a day. Boards cost only 10s. or less to make.

232.325. Tending (in both Seedbeds and Transplant Beds)

4321. Ny typ av ogräsrensare. **[New type of weeder.]** *Skogen* 47 (9), 1960 (192). [Sw.]

Describes, with an illustration, a weeder for use with a tractor, in which the blades rotate in the horizontal instead of the vertical plane. The speed giving the most effective cleaning proved in trials to be about 400–500 rev./min.

4322. LEONI, A. Esperimenti di lotta contro le erbe infestanti in un vivaio forestale con vecchio e nuovi diserbanti. **[Weed control experiments in a forest nursery with old and new weedkillers.]** *Monti e Boschi* 11 (3), 1960 (101–21). [It.f.e.]

During recent years, the Forestry Division of the Vita Mayer Paper Mill has carried out experiments on weed control in forest nurseries by means of chemicals. Weed control in the Company's nurseries is based on the following main principles: (1) Annual weeds are killed by such contact weedkillers as mineral white spirits, and solutions and emulsions of Pine-tar oils. (2) Couch grass and perennial weeds on fallow land and between rows in transplant beds are killed by aminotriazole sprays, followed by accurate tilling. Among the contact weedkillers, solutions of Pine-tar oils in aliphatic hydrocarbons, and water-emulsified tar oils gave the best results: low concentrations of tar oils in heptane are selective towards conifers; water emulsions do not damage needles > 1 year old. Tar oils and related weedkillers also proved to be best economically. *From author's summary.*

232.327. Protection Measures in Nurseries

See also Nos. 4314, 4315–6, 4554–8, 4589–90, 4716.

4323. **1958 annual report, Tropical Forest Research Center [Puerto Rico]. Yagrumo hembra planting.** *Carib. For.* 20 (1/2), 1958 (2–4). [E.]

Cecropia peltata was successfully propagated by sowing under shade and transplanting after ca. 10 weeks, when 4–6 in. tall. The transplant beds were heavily shaded for 2 weeks, after which the shade was gradually removed. When 10–24 in. tall, the transplants were ready for lifting. Field survival of bare-rooted transplants was not invariably satisfactory, but reached 80% in 6 localities in 1958. The best specimens were 6 ft. high in 7 months.

232.328. Vegetative Propagation

See also Nos. 4053, 4284–5, 4591.

4324. ROWE-DUTTON, P. **Mist propagation of cuttings.** *Digest, Commonwealth Bureau of Horticulture and Plantation Crops, East Malling* No. 2, 1959. pp. 135. 160 refs. Price 10*s*.

Reviews, from American and European literature, the types of apparatus available, methods of using them, and treatment of the cuttings. A 56-page table in an appendix summarizes the rooting results obtained with various plant species.

4325. KAPLAN, J., *et al.* **[Preliminary trials on the vegetative propagation of *Eucalyptus camaldulensis* [*rostrata*] and *Pinus halepensis*.]** *La-Yaaran* 8 (3/4), 1958 (5–8, 43). [Heb.e.]

Eucalypt cuttings of one-year wood, 20 cm. × 3–4 mm., taken in Sept.–Oct., immersed for 24 hours in 100–300 p.p.m. of IAA, IBA or NAA, or in a concentrated dip of one of these, inserted in red sand, and subjected to intermittent mist irrigation, gave up to 30% rooting within 2 months. Pine cuttings, 7–9 cm. long, treated as above, showed 10% rooting in 5 months. Air layers of the Eucalypt and Pine gave 5 and 15% rooting respectively when the notches or girdles were treated with 0·2–1% concentrations of these growth regulators with talcum powder or lanolin.

4326. MATTHEWS, J. D., WALLER, A. J., and POTTS, K. R. **Propagation of Leyland Cypress from cuttings.** *Quart. J. For.* 54 (2), 1960 (127–40). 7 refs.

Summarizes results of experiments covering 6 years. Cuttings should be taken from trees 5–20 years old, in late May to early June or in October, treated with IBA in talc, and planted in frames. Mist spraying gives definite advantages in rooting. The rooting medium should be an equal mixture of fine sand and granulated peat but, where misting is done, half the sand should be coarse and half fine. Successful rooting ranged from 50% in 12 months without heating, to 50–70% in 3–5 months with heat and mist combined. Rooted cuttings have survived planting on several different forest sites.

4327. NUKUMIZU, T., ANDO, M., and DOZONO, Y. **[On the relation of the rooting cutting percentage of Japanese Cedar to degrees of infection by *Botryosphaeria* sp.]** *Bull. For. Exp. Sta., Meguro, Tokyo* No. 119, 1960 (27–32). [Jap.jap.e.]

Gives details of a study of the resistance of *Cryptomeria japonica* to attack by *Botryosphaeria* sp. in the Obi district, showing the relationship between the degree of attack and the % of successfully rooted cuttings.

4328. YOSHIDA, T., *et al.* **[Studies on the methods of rooting the cuttings from old trees of Sugi (*Cryptomeria japonica* D. Don).]** *Bull. For. Exp. Sta., Meguro, Tokyo* No. 119, 1960 (33–57 + 5 plates). 21 refs. [Jap.jap.e.*e.*]

Describes experiments made in 1954–57, in which methods of improving the rooting of cuttings of old *C. japonica* were studied. This species is said to be difficult to root, but the results obtained by applying Na α-naphthalene-acetate to the cuttings were very satisfactory, especially when the treatment was preceded by the application of a sucrose solution. A urea leaf spray proved less effective, while the use of an electrically heated hotbed [diagrams given], in conjunction with the growth-regulator treatment and sucrose pre-treatment described, produced the best results [extensive tabulated data given in English]. A pre-treatment with $KMnO_4$ solution was less effective than that with sucrose.

4329. IS[H]IKAWA, H., and OOHASI, H. **[The vegetative propagation of cuttings of *Pinus* species. 2. The rooting of Japanese Red Pine [*P. densiflora*] using lateral twigs of an élite tree.]** *Bull. For. Exp. Sta., Meguro, Tokyo* No. 119, 1960 (59–65 + 1 plate). 9 refs. [Jap.jap.e.*e.*]

[Cf. *F.A.* 21 No. 1716.] Studies the effects of (1) the length of cuttings and (2) applications of growth regulators, on rooting responses, and the influence of bed media on the cuttings. (1) Twenty cuttings each of 0·5 and 5 cm. length were made from the lateral branches of a 33-year *P. densiflora* mother-tree (ht. 20·7 m.; d.b.h. 30·3 cm.), and planted in pots of red soil to 0·5 and 2·5 cm. depth respectively. Throughout the experiment, in which IBA at a rate of 10 mg./g. of powdered talc was applied, all the pots were placed in the open and watered once a day. Results (tabulated in English) indicate a 30% response, first observed after 84 days, for the longer cuttings, whereas all the shorter cuttings died. (2) Using the same mother stock, 0·5-cm. cuttings only were treated with IBA at 10 mg./g. and 1 mg./g. of powdered talc in 3 kinds of bed media, the best results being obtained for the higher treatment in a quartz-sand bed. All the cuttings in red soil died, but some planted in vermiculite took well, the higher application rate proving more effective in this medium also. Results obtained from IBA/talc combined with an aqueous solution of 2,4-D were inconclusive in the conditions described.

4330. BOGDANOV, B. Vkorenjaemost na reznici ot bradavičest čaškodrjan (*Evonymus verrucosa* Scop.) v zavisimost ot sezona na tjahnoto prigotvjane i vlijanieto na njakoi rastežni stimulatori. **[The rooting of *Euonymus verrucosus* cuttings in relation to the season of preparation and the effect of some growth regulators.]** *Nauč. Trud. Lesoteh. Inst., Sofija* No. 7, 1959 (47–65). 17 refs. [Bulg.g.]

Cuttings taken in late June from shoots of the current year gave best results; those taken in August were next best. Growth regulators increased the rooting %, α-NAA being better than β-IBA and 2,4-D.

4331. SEBALD, O. Untersuchungen über die Blattnervaturdichte verschieden alter Pappelklone. **[The venation density of leaves from Poplar clones of different ages.]** *Mitt. Ver. Forstl. Standortskunde ForstpflZücht.* No. 9, 1960 (72–4 + 6 photos). 11 refs. [G.g.]

Analysis of carefully prepared samples from leaves of 7- to 8-year-old trees of 8 clones, examined at magnifications of ×50 and ×75, revealed no correlation between density of venation and clone age. *P.* × *robusta*, ca. 60 years, ranked highest, with 14·5 islands (areas completely surrounded by veins) and 57·8 free vein endings per sq. mm., followed by *P.* × *serotina*, ca. 250 years. *P.* × *marilandica*, ca. 150–180 years, probably the second oldest clone, was last but one (the last being a pure *P. nigra* clone of unknown age) while the youngest clone, 'Jacometti 78B', stood 5th. Nor was there any correlation between age and number of stomata per sq. mm. Here 'Jacometti 78B' led, followed by *P.* × *serotina*, with *P.* × *marilandica* last. In another test, with 2-year-old plants, one of two clones recently developed from seedlings had more, the other fewer, veins (in mm./sq. mm.) and stomata/sq. mm. than the clones of *P.* × *robusta* and *P.* × *serotina* with which they were compared. [Cf. *F.A.* 18 No. 3990.]

4332. KEMMER, C., and VOGL, M. Antreib- und Aufzuchtsversuche an Pappeln im Winter. **[Forcing and growing tests on Poplars in winter.]** *Wiss. Abh. Dtsch. Akad. LandwWiss., Berl.* No. 47 (*Beitr. Pappelforsch.* No. 5), 1960 (7–26). 13 refs. [G.g. russ.e.]

Describes trials under hothouse conditions (midday ca. 23°, night 10–15° C.) during the dormant period from mid-November to January, on cuttings from one-year shoots of different species, varieties, and hybrids. Heat, cold, and ether successfully stimulated development, a 24-hour bath at 30°, or 24 hours refrigeration at −17° being particularly effective. The treatments greatly reduced, and in some cases reversed, the difference in flushing dates between the early-flushing *P.* × *marilandica* and the late-flushing *P.* × *serotina*. In some cases roots preceded leaves, in others vice versa. Root development was increased by darkness, particularly the slight darkening of the glass of the containers. The effect of treatments on flower development varied greatly, both cold and warm treatments causing accelerated development in some, and injury to inflorescences in others. Under natural light, forced shoots grew for short periods (10 cm. in 10 days for the earliest variants) and then stagnated, developing necrotic symptoms, so that 6 weeks after the beginning of the experiments, controls had nearly caught up. After transfer to continuous light, growth was soon resumed. The reason for the growth check appeared to be insufficient light rather than photoperiodism, for when forced cuttings were kept in (1) normal daylight, (2) north light plus night illumination of 600–800 luxes, or (3) continuous illumination of 700–1000 luxes, those in (3) grew vigorously and continuously (after a slow start), while those in (1) and (2) soon ceased growth and only resumed it on clear sunny days in late January. A terminal bud was formed only by untreated, unilluminated controls. All forced plants, but particularly (1), were highly susceptible to fungal infection, with considerable differences between varieties. This latter fact may make forcing a useful tool in testing resistance.

4333. ZABIELSKI, S. Wpływ wilgotności zrzezów topolowych na procent ich przyjęcia. **[The influence of the moisture content of Poplar cuttings on the percentage take.]** *Las Polski* 34 (9), 1960 (6–7). [Pol.]

Cuttings of *Populus* × *robusta* and *P.* × *regenerata* gave best survival % when soaked for 48 hours before planting; soaking for 24 hours also gave much better results than no soaking at all. Thick cuttings (9–12 mm. diam.) gave better survival than thin (7–9 mm.) ones.

4334. PETERSON, D. W., BLAKE, G. M., and PAULEY, S. S. **Propagation of American Basswood [*Tilia americana*] by cuttings.** *Minn. For. Note* No. 86, 1960. pp. 2.

Experiments indicate that cuttings taken in the dormant season will not root, but that softwood cuttings taken in late spring root fairly well.

4335. BLAKE, G. M., and PAULEY, S. S. **The vegetative propagation of Basswood [*Tilia americana*] by air-layers.** *Minn. For. Note* No. 85, 1960. pp. 2.

Experiments using a number of different treatments with IBA and IAA (in talc, in lanolin, in agar block), indicated that rooting can be induced best by 1% IBA in agar block, but none of the rooted air-layers survived when potted.

4336. FISCHER, F., and KOBERT, H. Beitrag zur Frage der vegetativen Vermehrung von Waldbaumarten. **[The vegetative propagation of forest trees.]**

Mitt. Schweiz. Anst. Forstl. Versuchsw. 36 (1), 1960 (4–14 + 4 photos). 27 refs. [G.g.f.it.e.]

Discusses and describes the horticultural technique of root grafting, which is thought to present a means of excluding one of the chief sources of phenological variability in grafted clones, i.e. that introduced by seedling stock (the other being topophysis). One-year-old cuttings from one 60-year-old and four 10-year-old Spruces were joined by various techniques to root cuttings 60–70 mm. long and 2–4 mm. in diam. taken from one 10-year-old Spruce. The point of union was placed 15–20 mm. deep in a peat/sand mixture. After 2 months, 82% of the 185 grafts had taken, including all those where root cuttings and scions had come from the same tree, and ca. 65% had produced new shoots and/or new root growth from the callus or the grafted root, whereas cuttings planted in the ordinary way at the same time had produced callus but no root or shoot growth. Thicker root sections gave better results than thin root ends.

4337. PERRY, T. O. **Pruning of Slash and Loblolly Pine grafts**. *J. For.* 58 (4), 1960 (323). 2 refs.

Investigations into *Pinus taeda* and *P. elliottii* grafting showed a high correlation between the absence of healthy branches on the stock and the development of a "milk-bottle"-shaped overgrowth of the scion by the stock, and consequent mortality. Evidently a phloem block was induced as a result of the grafting operation. It was concluded that some healthy branches should be left on the stock until the union has completely healed.

4338. SCHÖNBACH, H. Beobachtungen an heteroplastischen Pfropfungen innerhalb der Gattung *Populus*. [**Hetero-plastic graftings within the genus *Populus*.**] *Wiss. Abh. Dtsch. Akad. Landw-Wiss., Berl.* No. 47 (*Beitr. Pappelforsch.* No. 5), 1960 (27–41). 5 refs. [G.g.russ.e.]

Scions from 4 *Populus tremula* were grafted on 1-year-old rooted cuttings of *P. trichocarpa* (*a*) and *P.* × *'canadensis'* (*b*), on 1-year-old seedlings of *P. tremula* × *P. canescens* (*c*) and *P. tremula* × *P. alba* (*d*), and on unrooted setts of *Salix acutifolia* (*e*). Neither the % of 'takes' (highest on (*a*), lowest on (*e*)) nor 1st-year growth (about equal except on (*e*)) was a good indicator of compatibility, but 2nd-year growth (greatest in (*c*) and (*d*), followed in descending order by (*a*), (*b*) and (*e*)—the last named showing hardly any) and the onset of autumn coloration (in the order (*b*), (*e*), (*c*), (*d*), (*a*)) were On this basis, (*c*) and (*d*) were best, but the trial was. discontinued prematurely. Though (*a*) promised well at first, final results were unsatisfactory, and after 6–7 years many of the trees (stock + scion) were sickly or had died.

4339. JOSHI, N. J. **Ber [*Zizyphus mauritiana*] grafting in Banaskantha Division [Bombay]**. *Indian For.* 86 (3), 1960 (169–71).

Describes a successful experiment in grafting cultivated varieties on to the wild trees over 5 acres of forest, thus improving the quality of the fruit and increasing the revenue derived from it. The plot is expected to yield a net revenue of Rs. 860 p.a.

232.329. Miscellaneous (including Greenhouses, Frames, Raising in Pots, Tubes etc.)

4340. IRGENS-MOLLER, H. **Automatic control of photoperiod**. *Ecology* 41 (1), 1960 (222–3).

Describes methods used at Corvallis, Oregon, for the automatic control of photoperiod in greenhouse studies on *Pseudotsuga taxifolia* and *Alnus* sp. The plants are grown in separate compartments of growth chambers. These can be covered or uncovered as required by a means of a small motor, controlled by an electric time switch (wiring system shown), which moves a light-proof canvas belt, mounted on rollers, in either direction. Fluorescent lamps are fitted in the compartments and can be used either to supplement daylight or to give long-day treatment when the chambers are covered. Temperature in the greenhouse is only partially controlled, but is kept constant in all compartments even though under varying light treatments.

4341. **Polythene pots**. *For. Adv. Newslett. Colon. Off., Lond.* No. 7, 1960 (6–8). Limited distribution. I.F.B.

Contains notes on experience in 4 territories. Following experiments, the Northern Rhodesian Forest Department decided to use polythene tubes in place of paper pots wherever possible. Various comments on specifications, etc., are added. In Fiji and British Honduras an application of fertilizer has encouraged root growth of *Pinus caribaea* in polythene pots. The problem of transporting the large weight of soil with stock in polythene tubes from nursery to planting site is commented on from Nyasaland.

4342. LAMPRECHT, H., and BERNAL, E. J. Experimentos sobre el cultivo de plantas forestales en envases de carton parafinado. [**Raising forest plants in waxed cardboard containers**.] *Bol. Inst. For. Latino Amer., Mérida* No. 5, 1960 ([iii–iv], 34–46). [Span.e.]

Experiments were undertaken at Mérida in raising *Eucalyptus botryoides*, *E. citriodora* and *E. maidenii* in discarded milk cartons, in comparison with metal containers and ordinary nursery seed-beds. The milk cartons proved fully as suitable as the metal containers provided that they were perforated at the bottom. At Mérida the containers lasted 10–12 months, but their life can be lengthened by setting them on slightly inclined planks or on gravel, where they are well drained, allowing the air to circulate freely around them, giving them a second treatment with paraffin wax, and perforating the sides as well as the base. The cartons may be retained when planting out, since they disintegrate rapidly in the soil; they are also cheaper, lighter, and occupy less space than other types of container. [Cf. *F.A.* 21 No. 437.]

4343. GUIMARÃES, R. FOOT, GOMES, F. PIMENTEL, and MALAVOLTA, E. Adubação em mudas de *Eucalyptus saligna* Sm. [**Fertilizers for seedlings of *E. saligna*.**] *Rev. for. argent.* 4 (1), 1960 (15–9). [Port.port.]

Presents the results of statistically controlled experiments to estimate the effects of the addition of combinations of the mineral fertilizers $NaNO_3$, KCl and superphosphates to earth "bricks" used for growing and transplanting seedlings of *E. saligna*. The incorporation of 0·236 g. of N and 0·625 g. of P_2O_5 into each brick, as well as the addition of organic manure, proved definitely beneficial. No advantage seemed to result from the presence of K, but its incorporation improved the texture of the bricks.

4344. Leak, W. B. **Gibberellin reduces root growth of Yellow Birch seedlings.** *J. For.* 58 (4), 1960 (321). 2 refs.

The results of two small-scale tests on 1-month-old *Betula lutea* seedlings at Burlington, Vt., indicated that gibberellin, as used in these tests, is not suitable for use as a growth stimulant in the production of well balanced nursery stock. A 100 p.p.m aqueous solution of gibberellin was applied to the tips of the seedlings in 7 weekly doses increasing from 1 to 7 drops per seedling for one batch, and in 8 weekly doses increasing from 2 to 10 drops for a second. There was considerable mortality amongst both treated seedlings and controls. It was found when the seedlings were harvested, that gibberellin had greatly reduced root growth in terms of dry weight. Height growth was significantly stimulated, and stem dry weight was slightly more than for controls. Thus the root/stem ratio of the treated seedlings was much lower than for controls. [Cf. *F.A.* 19 No. 378.]

232.33. Formation of Stands by Direct Sowing

See also Nos. 4165, 4231, 4371, 4373, 4375–6.

4345. Strothmann, R. O., and Conover, D. F. **A field test of the Baker seed tool in Northeastern Minnesota.** *Tech. Note Lake St. For. Exp. Sta.* No. 579, 1960. pp. 2.

Sowing of *Pinus banksiana* and *P. resinosa* was carried out with the Baker seed tool from May to October on duff or on scalped spots; ¼ of all sown spots were screened for 2 years. It was found after 3 growing seasons that no treatment was successful. Spring tended to be better than autumn sowing, giving a best stocking of 7·6 vs. 2·4%. Survival on screened spots was 4 times that on unscreened spots. *P. resinosa* survived better on scalped spots than on duff; *P. banksiana* showed no clear difference. Results also varied considerably by area. The tool cannot be considered a useful device for restocking in N.E. Minnesota.

4346. **Furrow seeding in Alabama. Row seeding in Florida.** *Extr.* from *Rep. Sth. For. Exp. Sta. 1959*, 1960 (7–9). 2 refs.

Describes and illustrates the H-C Furrow Seeder, which is coupled to a conventional fire plough, so that soil preparation, sowing and covering is done in one single, one-man operation at any desired spacing. Results, particularly with *Pinus palustris*, were encouraging. In W. Florida a modified corn planter was used on cleared sandy sites.

4347. Schubert, G. H., Buck, J. M., and Evanko, A. B. **Rangeland drill used in reforestation in California.** *Misc. Pap. Pacif. Sthwest. For. Range Exp. Sta.* No. 42, 1960. pp. 4.

Preliminary report on a study installed at the Shasta-Trinity National Forests, in April 1959. Thick brush cover was cleared and windrowed with a dozer. A heavy-duty drill, designed to sow grass on rough rangeland, was calibrated to sow one *Pinus ponderosa* seed per foot of row. All but two seed openings were blocked to give 8 ft. spacing between rows. Seed was sown ½–1 in. deep and adequately covered by a log chain fastened to the rear of the drill. Germination was good.

4348. Smith, J. H. G., and Clark, M. B. **Growth and survival of Engelmann Spruce and Alpine Fir on seed spots at Bolean Lake, B.C., 1954–59.** *For. Chron.* 36 (1), 1960 (46–9, 51). 5 refs.

Seed-spots established in the spring of 1953 were remeasured in Aug. 1959. Variables included two species (*Picea engelmannii*, and *Abies lasiocarpa*); two site types—wet (*Vaccinium ovalifolium* association) and dry (*Vaccinium membranaceum* association); three degrees of light—full shade, part shade, and full sun; and five seedbeds—mineral soil, burn, moss, litter, and rotted wood. The observed data on survival and growth are further evidence of the need to provide adequately disturbed seedbeds to ensure reproduction of Engelmann Spruce and Alpine Fir. The poor survival, even with first-year screening, and slow juvenile growth of these species suggest that planting may have advantages over direct sowing. *From authors' abstract.*

4349. Branovickij, M. L. Iz opyta iskusstvennogo lesovozobnovlenija na koncentrirovannyh vyrubkah. **[Artificial regeneration trials on areas cleared by 'concentrated fellings'.]** *Lesn. Ž., Arhangel'sk* 2 (1), 1959 (65–71). 3 refs. [Russ.]

Gives the results of attempts to regenerate Pine and Spruce in several forest types in the taiga zone by: (*a*) direct sowing, using various methods and sowing rates; (*b*) planting with 1- and 3-year stock; and (*c*) aerial sowing. In almost all cases (*a*) and (*b*) gave satisfactory results, except on higher, drier ground and south slopes. With (*c*), results were generally very poor (only a few hundred seedlings per ha., and in some instances, where the felling areas were old and overgrown with grass, no seedlings at all). In only one case were reasonably good results obtained with (*c*); here the seedlings were mostly found on old skidding trails, narrow-gauge railway tracks, etc. Results indicate that (*c*) will be successful only on recently felled areas where the soil has been uniformly disturbed or scarified and also on recent burns. Even here there is a possibility that Birch and Aspen will invade the site later and impair the results of (*c*).

4350. Floyd, A. G. **Investigations into sowing of Flooded Gum (*Eucalyptus grandis*).** *Res. Note Div. For. Mgmt. For. Comm. N.S.W.* No. 2, 1960. pp. 30.

Reports on (1) broadcast sowing rates (2 oz. to 2 lb./acre recommended according to site conditions); (2) effect of seed-tree type (dominance and size of crown etc.) on seed germinability and plant %; (3)

methods of sowing, including site preparation (spot sowing from large, calibrated shakers a promising development).

232.4. Formation of Stands by Planting

See also Nos. 4349, 4375–6.

232.41. Planting Stock (Type, Handling and Treatment)

See also Nos. 4248, 4296, 4318, 4323, 4357, 4682.

4351. Madison, R. W. **Growth and survival of a Sitka Spruce plantation in coastal Oregon**. *Res. Note Pacif. Nthwest. For. Range Exp. Sta.* No. 178, 1959. pp. 6.

A report on the first 8 years of a study on the height growth and survival of *Picea sitchensis* at the Cascade Head Experimental Forest, W. Oregon. The area chosen was clear-felled (site class II), divided by a ridge into N. and S. slopes. Half of each slope was burned, thus giving 4 environmental conditions. In spring 1949, plots of one hundred 3 + 0 seedlings with 4-in. tops and 6-in. roots were planted in each of the 4 environments. Total survival for the first 8 growing seasons was 80·5%. The chief known cause for early deaths was smothering by debris and soil movement, but from 1953 onwards, competition from vegetation caused most mortality. Mean height in 1956 was 89·5 in. Factors reducing height growth were herbaceous competition and leader damage. Mean height growth and survival were better on the N. slope and on burned plots, but the difference was not statistically significant. Planting larger stock to give a further initial height advantage is recommended.

4352. Liu, F.-H. **[Some experiences in transplanting seedlings.]** *For. Sci., Peking* 1959 (1), (43–50). 10 refs. [Chin.e.]

Describes the techniques used in transplanting large quantities of wildings from forests in Hwang-Shan, Anhwei, to Nanking (ca. 120 miles away) in 1951, 1953 and 1954. These were lifted in their own earth, temporarily collected in a damp trench in the open, with ¼ to ⅓ of their foliage removed, and transported each in its own grass-woven basket by motor lorry. Survival was in some cases > 80%. Species mentioned include *Cinnamomum camphora*, *Syzygium buxifolium*, *Paliurus hemsleyanus* (least successful spp.), *Platycarya strobilacea*, *Pittosporum glabratum*, *Enkianthus chinensis*, *Rhododendron fortunei*, *R. anhweiensis*, *Castanopsis eyrei*, *Cephalotaxus harringtonia* var. *drupacea*, *Pinus taiwanensis*, *Illicium lanceolatum* and *Lithocarpus henryi*.

4353. Baur, G. N. **Raising and planting Flooded Gum**. *Res. Note Div. For. Mgmt. For. Comm. N.S.W.* No. 4, 1959. pp. 10. 6 refs.

Preliminary studies on nursery and planting techniques for Flooded Gum (*Eucalyptus grandis*) suggested that satisfactory field survival could be obtained by using bare-rooted nursery transplants rather than seedlings that had been top-pruned or root-wrenched, as the latter showed poorer survival after summer planting. Seedlings raised in containers all showed high survival, though growth was retarded when seedlings were planted out in veneer tubes. Small pots made from pulp and sphagnum appeared preferable both to the metal tubes currently used and to trays. Nursery establishment was improved by sowing the seed under partial shade and keeping it covered with sacking until germination. Relatively large seedlings were successfully transplanted into open metal tubes. Unhealthy plants and heavy tubing losses appeared to be associated with an essential factor present in soil from under established Flooded Gum but absent from the rain-forest soil normally used at the nursery. It is thought that this factor may be a mycorrhiza. [Cf. *F.A.* 20 No. 4500.]

4354. Jacobs, H. L. **Conservation and use of wood chips**. *Proc. 35th Nat. Shade Tree Conf. 1959*, 1959 (17–37). 17 refs.

Reviews uses of wood chips as mulches etc. and particularly experience in the use of large bins of wood chips for storing balled planting stock of a large size (trees of 3–10 in. diam.). With regular watering and addition of N, such plants have been kept through several growing seasons. The need to regulate the temperature of the chip piles is emphasized, and root growth is described.

232.42. Methods of Planting (including Use of Fertilizers etc.)

See also Nos. 4139, 4372, 4374, 4430, 4434, 4450.

4355. Chang, Y.-L. **[Observations on the growth of young plants, and on preventing surface run-off, with planting in holes and contour ditches.]** *For. Sci., Peking* 1960 (2), (125–31). [Chin.russ.]

This method of planting, as practised in the Yuhsien region of Honan, prevented surface run-off, provided adequate water for young plants, and resulted in 80–90% survival.

4356. Stiell, W. M. **A co-operative experimental planting project in Ontario**. *Pulp Paper Mag. Can.* 61 (2), 1960 (114–7). 2 refs.

[Cf. *F.A.* 20 No. 455.] Compares the saddle and half-saddle planting methods with "conventional" methods (wedge, hole, 3-sided holes, slit, T-slit, L-slit, Lowther machine) for planting White and Black Spruce. It is concluded that, on the evidence to date, the saddle and half-saddle methods are too difficult and costly to justify general adoption.

4357. Switzer, G. L. **Exposure and planting depth effects on Loblolly Pine planting stock on poorly drained sites**. *J. For.* 58 (5), 1960 (390–1). 5 refs.

Bare-rooted one-year-old *Pinus taeda* seedlings were planted on poorly drained clay and silt sites in N.E. Mississippi with 5 replicated treatments: (*a*) correct planting depth with (1) no additional exposure, (2) 5 min. exposure, (3) 10 min. exposure; (*b*) planting with (4) half and (5) whole stem buried, and no additional exposure. Survival decreased consistently with increased root exposure (the decrease being more marked on silt), and also with increased planting depth. Height of seedlings after the first field growing season indicated that the effect of exposure was to eliminate the less vigorous plants. The results of these trials were at variance with those obtained by Slocum and Maki [cf. *F.A.* 17 Nos. 2748, 3899].

4358. **[Dosages of fertilizer for *Pinus caribaea*.]** *Extr.* from *Colon. Res., Lond. 1958/59*, 1959 (97).

The first assessment of a plot established in British Honduras in 1956 indicates that applications of triple superphosphate at 1 oz. and 2 oz./plant show only slightly better results than ½ oz., but that plants treated with ½ oz. have significantly better growth than controls.

4359. SIMON, K.-H. Untersuchungen zur künstlichen Bodenbedeckung in Kiefernkulturen unter besonderer Berücksichtigung des Mikroklimas. **[Mulching of Pine plantations, especially its effect on microclimate.]** *Arch. Forstw.* 9 (2), 1960 (109–35). 21 refs. [G.g.russ.e.]

A longer extract from the thesis noticed in *F.A.* 21 No. 454. Effects on increment were for the most part not significant, but twig mulching gave some protection against browsing and appeared to reduce Mg deficiency. Mulching with shavings, after cultivation, significantly increased the mean height of seedlings of *Quercus borealis*.

4360. MEYR, R. Einsatz einer neuen Einmann-Pflanzlochbohrmaschine. **[A new one-man plant-hole borer.]** *Allg. Forstztg.* 71 (9/10), 1960 (107). [G.]

Describes the Vago-Ideal, a mechanical plant-hole borer mounted on a tubular steel frame shaped like a wheelbarrow, having a rubber wheel, the two supports being adjustable in height and fitted with strong steel spikes. The machine can be easily moved from place to place by one man, and stands so firmly even on steep slopes that it needs to be neither held nor steadied, and the operator need only control the borer itself by means of a handle fitted to its shaft. Since the borer speed is geared down to only 60 rev./min., the 4-h.p. four-stroke petrol motor develops sufficient power at a steady engine speed, and the soil is not thrown out violently. The frame takes all the vibration. In a 3-day demonstration on a 30% slope, an average of 101 holes were made in an hour, including intervals for moving from hole to hole, cleaning the borer, and allowing short rests for the operator.

232.43. Spacing and Arrangement in Plantations

See also Nos. 4226, 4406, 4568.

4361. WAUTHOZ, V. Boisements de mélèzes du Japon: écartement des plants. **[Spacing in Japanese Larch plantations.]** *Bull. Soc. For. Belg.* 67 (3), 1960 (136–40). [F.]

A study of costs of establishment, and thinning costs and returns, up to 30 years, of plantations spaced (*a*) 1·5 × 1·5 m., and (*b*) 2 × 2 m. leads to the view that (*b*) is the more economic.

4362. SCHRÖTTER, H. Beobachtungen an mehrjährigen Nesterpflanzungen mit Kiefer. **[Observations on nest plantings of Pine some years after planting.]** *Forst u. Jagd* 10 (3), 1960 (134–6). 11 refs. [G.g.]

Evaluation of ca. 20 ha. planted in 1953 or later showed poor results on weed-infested sites. On less weed-infested sites the 'nests' were about equal to row plantings, but much more wasteful of space. The method is thought suitable for enriching natural Oak regeneration with Pine. [Cf. *F.A.* 21 No. 3093.]

232.5. Artificial Formation of Stands by Vegetative Propagation

See also No. 4186.

4363. HUPPUCH, C. D. **The effect of site preparation on survival and growth of Sycamore cuttings.** *Res. Note Stheast. For. Exp. Sta.* No. 140, 1960. pp. 2.

In an exploratory study in a Georgia old field, first- and second-year growth of *Platanus occidentalis* cuttings was best after the most elaborate soil preparation, viz. disk harrowing followed by two cultivations. It was satisfactory after disk harrowing alone, and after ploughing double furrows, but less so (though still better than on controls) after pretreatment of the soil with an aqueous spray of trichloroacetic acid. An 8/8/8 fertilizer, placed in the planting hole and also applied once later, increased height growth, but also mortality, presumably because of faulty application.

4364. FISCHER, F. Die Verwendung von Setzstangen beim Pappelanbau im Apfelstädt-Tal bei Gotha/Thüringen. **[The use of setts in Poplar planting in the Apfelstädt valley near Gotha, Thuringia.]** *Forst u. Jagd* 10 (3), 1960 (107–8). [G.]

Describes the use of setts ⩾ 2·5 m. long in a poor gravelly soil with a low water-table, where rooted cuttings had failed. The planting hole was made by driving a pointed steel bar 2 m. long and 4·5 cm. thick ca. 1·5 m. into the ground, but it remains to be seen whether the results will equal the pre-war practice of planting of setts in large dug holes.

233. Afforestation

See also Nos. 3967, 4142, 4355, 4379, 4381, 5205, 5207–8, 5211, 5213.

4365. STRNKA, M. Zalesňovanie Tatranského národného parku listnatými drevinami a jed'ou. **[Afforestation of the Tatra National Park with broadleaved species and Silver Fir.]** Knižnica Sborníka Prác o Tatranskom Národnom Parku, Tatranske Lomnica. 1959. pp. 74. 1 ref. [Slovak.russ.g.] Price *Kčs.* 5.60.

Afforestation has been going on over the last 30 years, and especially in the last decade, in order to introduce broadleaved species and Silver Fir into the park forests, which are predominantly of Spruce. The effect of game damage (mainly deer and hares) on afforestation is analysed both by tree species and by method of sowing or planting. Damage to seedlings and young plants in the three different areas investigated averaged 54, 70 and 92%. Afforestation costs are reviewed, and it is concluded that plantations can be successfully established only if they are protected from game damage.

4366. GRAVATO, A. M. A adaptação de algumas espécies florestais na Serra do Marão. **[The suitability of some forest species for the Serra do Marão.]** *Agros* 42 (5), 1959 (633–44). [Port.]

Presents short notes on the silvicultural characters and behaviour of species successfully used for afforestation in this mountainous region, the most important being *Pinus pinaster*, *P. sylvestris*, *Pseudotsuga taxifolia* and *Betula pubescens*.

4367. STEFANELLI, A. Premesse bioecologiche alla ricostituzione forestale del Carso Isontino. **[Ecological conditions for the reforestation of the Karst region of the Isonzo valley.]** *Monti e Boschi* 11 (4), 1960 (152–64). 9 refs. [It.f.e.]

Describes the environment and existing vegetation of the region, and planting so far carried out, mainly with *Pinus sylvestris* and *P. nigra* var. *austriaca*.

4368. Bor′ba s ėroziej počv putem lesorazvedenija. **[Erosion control by establishing forests.]** *Trud. Inst. Les.* No. 44, 1959 (5–102). Many refs. [Russ.]

Five papers: Results of quantitative investigations on erosion processes [in the Cis-Volga Uplands] by analysing series of special maps (*V. P. Lidov* and *L. E. Setunskaja*); Investigations on soil erosion in the Cis-Volga Uplands (*N. M. Bespalova*); Plant cover on eroded slopes and its influence on erosion processes in the Cis-Volga Uplands (*M. V. Nadeždina*); Choice of tree and shrub species and agricultural techniques for raising forest plantations on sheet-eroded and gravelly soils of the Cis-Volga Uplands (*N. T. Makaryčev*) [recommends, in considerable detail for the various areas and soil types, many trees and shrubs suitable for planting, and notes some species which should not be used]; Ravines and their growth (*V. P. Lidov, et al.*) [the results of geomorphological investigations in the Rostov, Voronezh and Tambov regions].

4369. GOURASAS, I. Stereōsis kai axiopoiēsis tōn thinōn Bartholomiou, Lygias, Glyphas, nomou Ēleias. **[Stabilization and improvement of dunes at Vartholomion, Lygia and Glyfas, Ilia province.]** *Das. Chron.* 2 (15), 1960 (660–5). [Gk.]

Describes the progress of dune-stabilization work started in 1952 N.W. of the coastal village of Vartholomion [Peloponnesus], where an area of sand, already some 20,000 stremmas [ca. 5000 acres] in extent had been encroaching for years on cultivated land. Wattle fencing up to 1·20 m. high was erected on the dune tops, at first in lines and later (since the wind could blow from any direction) to form series of enclosures. In the shelter thus provided, herbaceous plants, e.g. lupins, *Cynodon*, *Asphodelus*, and trees, chiefly *Pinus halepensis*, *P. brutia*, *P. pinea*, *Cupressus sempervirens*, *Robinia pseudoacacia*, *Eucalyptus rostrata*, *Populus* × *canadensis*, *P. alba*, *Salix* and *Tamarix* spp. were planted out, and most of them have done well—Pines being 2–4·50 m. high, Cypress 3–4 m., and Eucalypts 8–9 m. after 6–7 years. The sand is no longer on the move and the whole area is expected to become productive.

4370. CEPLJAEV, V. P. Ob ulučšenii lesnogo hozjajstva i zaščitnogo lesorazvedenija v Srednej Azii. **[Improvement of forestry and shelterbelt management in Central Asia.]** *Vestn. sel′.-hoz. Nauki* 5 (1), 1960 (70–6). [Russ.e.g.f.] O.W.

Presents data on the areas and standing volume of *Haloxylon* spp., *Tamarix* spp., *Ammodendron conollyi* and *Salsola arbuscula* in Kazakhstan, Uzbekistan and Turkmenistan, and discusses, in general terms, afforestation for desert reclamation in the area.

4371. GOSWAMI, P. C. **A note on contour trenching and soil moisture in afforestation sites.** *Indian For.* 86 (4), 1960 (198–204).

The costly technique of dibbling seeds into ridges along contour trenches, which was used on a large scale on afforestation sites in the Chotanagpur region of Bihar, has been abandoned as unsatisfactory. Except on extremely steep and barren sites, erosion is prevented, without need of trenches, by the ground vegetation that returns with exclusion of grazing and fire. Casualties among dibbled seedlings were heavy in the first dry season at 9–11 months. They grew no better than seedlings in worked contour strips. Soil samples taken in the Upper Damodar Valley in mid-May, when there had been no rain for 72 days, showed that moisture content at 20-in. depth in the seedbed was 4·72 for worked strips vs. 4·58% for ridges. In the top 12 in., m.c. in ridges was lower than in worked strips and in the top 6 in., lower than in unworked soil also.

4372. BISWAS, G. S. **Afforestation of *beel* areas in Malda Forest Division [W. Bengal].** *Indian For.* 86 (3), 1960 (172–6).

The great fluctuations in water level in these swamps, and various other adverse climatic factors, create serious difficulties. A plantation technique has been developed, by which large seedlings of suitable species are ball-planted together on large mounds, high enough and so designed as to resist flood damage. They should be established well before the seasonal flooding of the *beel* areas.

4373. BROWN, J. H., and TRYON, E. H. **Establishment of seeded Black Locust on spoil banks.** *Bull. W. Va. Agric. Exp. Sta.* No. 440, 1960. pp. 33. 13 refs.

A sample survey of spoilbanks from open-cast mining in Ohio, sown since 1945, indicated that on 20% of the area the cover was adequate, on 50% definitely not so. Establishment of Robinia and 37 naturally occurring tree species was positively related to rising pH and decreasing steepness. Periods of low precipitation adversely affected establishment. November to March appeared to be the best season for sowing. *From authors' summary.*

4374. **Revegetating eroding coastal plain sites.** *Extr.* from *Rep. Sth. For. Exp. Sta. 1959*, 1960 (25–6).

Planting Pines in eroded gullies became economically and technically practicable with the use of mechanical portable post-hole diggers to dig 6-in. holes 1 ft. deep. Third-year survival of Loblolly so planted was 86% when a straw mulch had been given, and 76% without, vs. 66% in mattock-planted controls; mean heights were 2·7, 1·9 and 1·4 ft. respectively. On moist sites, a two-man crew could dig one hole a minute.

235. Underplanting, Advance Planting etc. Nurses and Formation of Mixtures. Interplanting of Inferior Growth

See also No. 4770.

4375. VALENTINI, J. A. Crecimiento de la "tipa blanca" y su comportamiento como especie protectora. **[Development of *Tipuana tipu* and its behaviour as a nurse species.]** *Notas silvic. Adm. Nac. Bosques, B. Aires* No. 1, 1959. pp. 3. [Span.]

Reports trials with *T. tipu* in the lowlands of the southern part of the Chaco Territory. Nursery stock 1½ years old was planted in July 1947 at 2 × 2 m. on a site previously ploughed and harrowed. In 1950 an understorey of *Tabebuia ipe* was introduced by ball-planting nursery stock [age not given] in the centres of the rectangles formed by *Tipuana tipu*. In 1953 direct sowings were also made of *Astronium balansae*, *Gleditsia amorphoides* and *Piptadenia macrocarpa* [spacings not given]. By the 10th year of growth, m.a.i. of *T. tipu* was 20 cu. m./ha. and, in addition, its usefulness as a nurse to the more susceptible species was definitely established. A first thinning was made at the age of 10 years, yielding 5744 kg. of wood products per ha.

4376. MOSKALENKO, A. A. K voprosu o rekonstrukcii malocennyh molodnjakov. **[Enrichment of young stands of low value.]** *Lesn. Ž., Arhangel'sk* 2 (1), 1959 (72–4). 3 refs. [Russ.]

Oak (nest-sown in 1950, 72 acorns per patch of 1·5 × 2 m.), and Pine (2-year seedlings, planted in 1952 at 16 plants per patch of 1 × 1 m.) were introduced into stands of low-grade hardwoods and Hazel coppice on an area clear-felled in 1938. Investigation of the Oak in 1953 and the Pine in 1955 showed that survival, particularly of Pine, decreased with increasing shade, and that for optimum light the distance from the patch to the existing stand should be not less than the mean stand height.

236. Care of Regeneration or Plantations in the Initial Stages of Establishment

See also Nos. 4434, 4450, 4540–1, 5232.

4377. SCHWEND. Jungbestandspflege im Stücklohn. **[Tending young stands on a piece-rate basis.]** *Allg. Forstzeitschr.* 15 (17), 1960 (249–52). [G.]

Describes a system introduced into S. Württemberg, based on tables (developed by the Technische Zentralstelle für Forstwirtschaft) showing the standard number of individual actions per hour in each of 5 stand types—naturally and artificially regenerated Spruce, conifers with hardwoods, hardwoods with conifers, hardwoods only—for various height classes from 0·5 to 10 m. Local rates are fixed after determining the number of actions necessary per ha. on sample areas. Savings averaged 40–50% in time, 30% in wages. Naturally regenerated Beech and Spruce/Silver Fir were the most expensive to tend. Planted Spruce and planted mixtures cost about the same.

237. Amelioration of Forest Sites

See also Nos. 3972–3, 3978, 4142, 4358–9, 4942, 5230.

4378. P'JAVČENKO, N. I. [Editor]. Materialy bo izučeniju lesorastitel'nyh uslovij na torfjano-polotnyh počvah lesnoj zony i v tundre. **[Studies on forest growth conditions on peat-bog soils of the forest zone and the tundra.]** *Trud. Inst. Les.* No. 36, 1957. pp. 186. Many refs. [Russ.]

Seven papers: Forest bog types in the N. Dvina basin (*N. I. P'javčenko*) [classification, description, chemical analysis]; Forest soil fauna of the Kotlas leskhoz (*L. S. Kozlovskaja*) [tabulates data on numbers and proportions of soil fauna for 7 forest types]; The effectiveness of drainage on potentially rich soils (*E. D. Sabo*) [analysis of growth in Scots Pine stands after drainage]; The growth of young Pine stands on peat soils after drainage (*S. E. Vomperskij*) [analysis of growth of Scots Pine in natural stands and plantations, after drainage, with special reference to distance from drainage channels]; Growing conditions for woody plants at their N. limit (*N. I. P'javčenko*) [in the southern parts of the tundra at Vorkuta and Norilsk]; Comparison of the soil fauna in the Usa basin N. of the Arctic Circle (*L. S. Kozlovskaja*) [on plots in the N. taiga fringe, the taiga/tundra belt, and the tundra]; The "lower" Spruce phase in peat deposits (*N. I. P'javčenko*) [reviews Russian literature on the history of Spruce in N.W. Russia].

4379. P'JAVČENKO, N. I. [Editor]. Povyšenie produktivnosti zaboločennyh lesov. **[Increasing the productivity of boggy forests.]** *Trud. Inst. Les.* No. 49, 1959. pp. 146. Many refs. [Russ.]

Twenty papers presented at a conference in Moscow, Dec. 1957: Forest drainage in the U.S.S.R. (*M. G. Pinčuk*); Typology of boggy forests with a view to drainage measures (*N. I. P'javčenko*); The role of Ca in the decomposition of peat in forest bogs (*B. D. Zajcev*) [cf. *F.A.* 14 No. 19; 21 No. 13]; Some data on forest growth conditions on drained transitional bogs (*P. I. Kollist*) [cf. *F.A.* 21 No. 3122]; The role of the soil fauna in the breakdown of organic remains in boggy forest soils (*L. S. Kozlovskaja*); The influence of the natural properties of boggy forest massifs on the building and use of timber extraction roads (*E. A. Galkina*); Regulation of the hydrological regime of land becoming boggy, by biological methods (*A. A. Molčanov*) [cf. *F.A.* 20 No. 2716]; Results of work on increasing the yield from boggy forests through drainage (*E. D. Sabo*); Intensity of forest drainage in Latvia (*Ja. Ja. Kljavin'š*) [cf. *F.A.* 21 No. 3123]; Forest drainage work in Estonia (*L. A. Polli*) [cf. *F.A.* 21 No. 3121]; Methods of using aerial photographs in investigations on the improvement of forest hydrology (*I. D. Dmitriev*); The work of VNIILM on forest drainage (*N. F. Sozykin*) [cf. *F.A.* 7 Nos. 570, 1060, 1564–5]; Increasing the yield of boggy forests through drainage (*V. Hajnla*); Forest drainage efficiency in relation to the quality of peat soils (*S. Ė. Vomperskij*) [cf. *F.A.* 21 No. 1346]; Problems of forestry and agriculture in the utilization of unforested raised bogs in Estonia (*U. Valk*); Lime as a means of moss control in plantations on moss-covered felled areas and bogs to be drained (*P. L. Bogdanov*); Afforestation of clear-felled areas covered with *Polytrichum* sp. (*V. G. Čertovskoj*); Drainage as a means of ensuring forest regeneration (*V. G. Rubcov*); The repairing of drainage systems in the *Pinetum sphagnosum* and *P. polytrichosum* (*V. D. Grigor′ev*); Basic principles and methods of hydrological improvements in the Poles′e forests (*S. H. Bukyka*).

4380. Orlov, A. Ja., and Izvekov, A. A. Izmenenie lesorastitel′nyh svojstv torfjanisto-peregnojnyh počv pri ih osušenii. **[The change in the forest growth properties of peaty-humus soils due to drainage.]** *Počvoved.* 1960 (2), (40–9). 5 refs. [Russ.e.] A.P.B.

Experimental drainage was done in 1957 in the Vologda region on (1) an area clear-felled the previous winter and planted up with Spruce, and (2) a 15-year-old burn carrying a Birch/Willow thicket with a Spruce understorey. Both sites were on a peaty-humus gley-type soil with the peaty horizon 5–7 cm. thick, on a slope of ca. 1·5°. Drainage ditches 30–40 cm. deep were dug at top and bottom of both sites and connected by channels 10 m. apart. Soil m.c. was significantly reduced by drainage, and in 1958 the top 20 cm. of soil was flooded by groundwater for only 7 days, compared with 40 days on control plots. Drainage also reduced the content of available Fe, but had no appreciable influence on the contents of available N, P, and K in the soil. However, it usually resulted in increased N, P and K in the needles and shoots of Spruce and in Birch leaves.

4381. Giulimondi, G., and Arru, G. M. Primi risultati di esperienze di correzione di terreni argillosi per l'impianto dell'eucalitto. **[First results of experiments in the improvement of clayey [solonchak] soils for planting Eucalypts.]** *Pubbl. Cent. Sper. Agric. For., Roma* No. 3, 1959 (1960), (255–64 + 1 tbl.). 8 refs. [It.it.e.*e*.]

A preliminary field experiment was initiated in 1956 on a solonchak soil in S. Italy, in order to determine the adaptability of some Eucalypt species to this type of soil with the help of chemical amendments. All species were stunted during the first 3 years owing to the structural anomalies of the soil. On treated plots, *Eucalyptus leucoxylon* var. *rosea*, and *E.* × *trabutii* showed the highest rate of survival, *E. camphora* and *E. resinifera* were intermediate, and *E. botryoides*, *E. aggregata* and *E. goniocalyx* showed very poor survival. FeSO$_4$ (10 metric tons/ha.) gave better results than gypsum (10 and 20 metric tons/ha.).

4382. Holmes, G. D., and Cousins, D. A. **Application of fertilizers to checked plantations.** *Forestry* 33 (1), 1960 (54–73 + 4 photos). 6 refs.

In April 1959 an aircraft was used for the first time in Britain to broadcast fertilizers on to an existing forest crop. This operation was the culmination of investigations over the previous 8 years into the causes of slow growth of Spruce plantations (*Picea* spp.) over appreciable areas of soils derived from Culm Measures, notably at Wilsey Down forest, Cornwall, and Halwill forest, Devon. At these sites, many plantations dating from the early 1930's are almost completely 'checked', having failed to close canopy in up to 30 years. Recent experiments have suggested that nutrient deficiencies are largely responsible for the failure, and in 1957–9 the trials were extended to include exercises in the use of aircraft for spreading fertilizers on a practical forest scale. Results of the experiments (using a Tiger Moth) are given in some detail, and the following conclusions drawn: (1) The techniques of fertilizer dressings from a light aircraft could be used over a wide range of forest conditions. (2) With granular fertilizer at 2–3 cwt./acre, a rate of 15–25 acres/hour can be achieved provided that the air strip is ≯ 3 miles from the dropping zone. Distance from the air strip was the critical factor, efficiency falling off sharply as the distance is increased beyond 3 miles. (3) Control of application rates was satisfactory in final trials, though there was at first some difficulty in correct calibration of the delivery control. (4) Uniformity of spreading was not always achieved, and there is room for improvement in the design of the spreading gear. (5) Irregular topography appears to be no great obstacle, and provided that a landing-strip of ≮ 350–400 yards is available, a fixed-wing machine seems the best type of aircraft for most forestry work. (6) Cost of application will vary with circumstances and scale of work, but it will be of the order of 20*s*./3 cwt./acre.

4383. Sekawin, M. Notizie sulla concimazione del pioppeto. **[Fertilizing Poplar plantations.]** *Cellulosa e Carta* 11 (5), 1960 (5–8). 8 refs. [It.it. f.e.g.]

Briefly reviews the literature and concludes that fertilizers are more effective when spread over the whole area rather than applied locally, and that best results are achieved by the use of a balanced NPK fertilizer.

4384. Schmid, E. Bisherige Ergebnisse sechsjähriger Kalkdüngungsversuche. **[Results to date of six-year-old liming trials.]** *Allg. Forstztg.* 71 (9/10), 1960 (99–103 + 2 plates). 1 ref. [G.g.]

Liming trials on 3 raw-humus sites in Upper Austria generally showed best results, in terms of pH, N enrichment, changes in ground flora, biological activity and increment, for the largest dosages, equivalent to 10 metric tons/ha. of CaO. Results were generally better for CaO, Ca(OH)$_2$ or CaCO$_3$ + CaO than for the cheaper CaCO$_3$, but the differences appeared to be largely temporary. [Cf. *F.A.* 18 No. 1592; 21 No. 3132.]

238. Timber Plantation Crops requiring Special Treatment

See Nos. 4250, 4364, 4383.

24. Tending of Stands and Trees

See also Nos. 4377, 4678.

242. Thinning

See also Nos. 4143, 4227–9, 4568, 4773, 4775.

4385. DAWKINS, H. C. **The Pudden clinal plot; thinning experiments without surrounds.** *Emp. For. Rev.* 39 (2), 1960 (168–71).

Describes a system devised by H. C. Pudden which obviates the need for large surrounds and provides results suitable for statistical analysis. Plots are placed side by side, in order of thinning intensity, each differing fractionally from its neighbour, so that marginal effects are negligible. Each treatment is specified by a constant, which is the regular annual increase in tree space given to the main-crop trees, in sq. ft. per tree per year. Directional tendencies in a given site can be eliminated by using two adjacent series of plots declining in opposite directions. A fourfold lay-out is also illustrated. Details of the application of the Pudden system to a *Pinus patula* crop are tabulated.

4386. Enige literatuur over stamtaldunning. **[Some literature on thinning by stem number.]** Centrum voor Landbouwpublikaties en Landbouwdocumentatie, Wageningen. 1959. pp. 1. [Du.]

Lists 8 Netherlands references on Hart's method and 3 (U.S.A., Germany and U.K.) on thinning by stem number in general.

4387. ASSMANN, E. Über Brauchbarkeit des Verfahrens von Hart-Becking zum Festlegen der Durchforstungsstärke. **[The utility of the Hart-Becking method of determining thinning grade.]** *Forstwiss. Cbl.* 79 (3/4), 1960 (65–72). 8 refs. [G.]

Describes the method [cf. *F.A.* 14 No. 1453; 15 No. 3559], tests it on Spruce, and compares it with the author's own method [cf. *F.A.* 19 No. 4192].

4388. STAEBLER, G. R. **Theoretical derivation of numerical thinning schedules for Douglas Fir.** *For. Sci.* 6 (2), 1960 (98–109). 24 refs.

Proposes a method using the gross yield (g.y.) tables for the species [see *F.A.* 18 No. 773]. The schedule is a rigorous, mathematical model based on easily defensible biological theory [see *F.A.* 19 No. 3323]; it is presented as a logical method of regulating intermediate fellings for production of full gross increment in trees growing at a chosen rate with a minimum of growing stock. Thinning schedules are derived from g.y. tables for untended stands, assuming that (*a*) gross cu.-ft. increment represents full productive capacity of the site, and (*b*) this increment may be distributed over many or few trees. The derived schedule is compared with other proposed numerical thinning schedules for Douglas Fir; in general, these latter require a greater number of trees, especially at young ages. The gross-yield tables may underestimate the yield possible under intensive management.

4389. HENGST, E.; WAGENKNECHT, E., and FLÖHR, W. Über den Durchforstungsgrad im Douglasienreinbestand. **[Thinning intensities in pure Douglas Fir.]** *Arch. Forstw.* 9 (2), 1960 (149–71). 6 refs. [G.g.russ.e.]

Hengst questions the heavy thinning advocated by Wagenknecht and Flöhr, and presents data by crown-diameter classes on the relationship of crown and stem size and p.a.i. in a 40-year stand of site class II, which indicate that increase in crown diameter beyond 2·9 m. does not give any further increment. Wagenknecht and Flöhr, in reply, seek to prove that, if properly carried out, their programme, which envisages very heavy early thinnings, decreasing to light thinnings after age 60, will not have the alleged adverse effects on b.a. and increment development.

4390. **Bulldozer thinning of Lodgepole Pine.** *Extr.* from *Rep. Intermt. For. Range Exp. Sta. 1959*, 1960 (5–6).

A study is being made of strip thinning to several intensities with a bulldozer in a 30-year even-aged *Pinus contorta* stand. Reactions to thinning by this method in terms of diam., b.a., and height increment during the 5-year period after treatment are tabulated. Diameter-increment responses are nearly as great as those reported from selective thinnings. Depression of height growth with increased release is not unusual, but is contrary to results from most selective thinnings. Strip thinning also improves access to overstocked stands.

4391. SVIRIDOVA, I. K. Rol′ rubok uhoda v povyšenii plodorodija lesnyh počv. **[Role of tending operations [thinnings] in increasing the fertility of forest soils.]** *Počvoved.* 1960 (4), (68–73). 4 refs. [Russ.russ.e.] A.P.B.

Investigations were made into the effect on soil fertility of thinning (in 1952) to density 0·75 and 0·8 in Aspen stands (*Carex*/*Aegopodium podagraria* type), 30 and 55 years old, on grey-brown forest soils (loamy sands) in the Voronezh area [cf. *F.A.* 16 Nos. 2749, 2755]. Data are tabulated for 1955–58 on the amounts and chemical composition of Aspen litter and grass litter, and the chemical, physical and hydrological properties of the soil on thinned and unthinned plots. Thinning increased the rate of circulation of N and ash elements, and increased the total litter fall, of which Aspen litter accounted for 92% by weight. This in turn increased the contents of humus, Ca, P, K and N in the humus horizon (2–10 cm.) of the soil, and also improved the physical and hydrological properties of the soil, particularly by increasing its moisture content.

4392. TEPPER, H. B., and BAMFORD, G. T. **Effect of one low thinning on cove and slope hardwoods in the New Jersey highlands.** *Sta. Pap. Ntheast. For. Exp. Sta.* No. 129, 1959. pp. 11. 4 refs.

In 1928, four ¼-acre plots were established in an 18-year stand: 2 plots on a sloping site stocked chiefly with Red Oaks and Hickory, and 2 in the cove of a valley, where the trees were mainly Yellow-Poplar [*Liriodendron tulipifera*], White Ash, and Red Maple. A low thinning was applied to one plot of each pair, removing 61–64% of stems and 44–49% of b.a. Over a 27-year period, the chief effects of thinning the slope stand were to reduce mortality and to concentrate growth on fewer, slightly larger trees than in the control. Effects on the cove sites were much greater, largely because the thinning caused Yellow Poplar to form a higher

% of the stand. Though volume at 45 years on the thinned plot differed little from the control, it was in larger and better-quality stems, and in more desirable species; while both plots had about the same number of Yellow Poplar crop trees at 18 years, at 45 years the thinned plot had twice as many. *From authors' summary.*

4393. Tepper, H. B., and Bamford, G. T. **Thinning Sweetgum stands in southern New Jersey.** *For. Res. Note Ntheast. For. Exp. Sta.* No. 95, 1960. pp. 3. 4 refs.

In 1928, 3 plots of ca. 0·1 acre each were established in an 11-year *Liquidambar styraciflua* stand on poorly drained and abandoned ground of site index 85. On one plot, 49% of stems were removed in a low thinning. In 1958 it was found that the unthinned plots had made good growth, and at 41 years contained 4896 cu. ft./acre merchantable volume. However, the growth rate had declined markedly with increasing age; between 21 and 26 years, growth was 1274 cu. ft., vs. 264 cu. ft./acre between 36 and 41 years. Crop trees showed a smaller decline, but up to 26 years they grew 1·3–1·6 in. in diameter per 5 years, vs. ca. 0·5 in. for each subsequent 5-year period. On the thinned plot, mortality was reduced, but over the 30-year period the effect of thinning on crop-tree growth was negligible. It was concluded that 11 years was too early to thin; the decrease in growth rate after 25 years suggested that thinning should be done at 20–25 years.

243. Opening of the Canopy (Increment Fellings, Overhead Release and Improvement Fellings)

4394. Hallin, W. E. **Release of Sugar Pine seedlings and saplings by harvest cutting.** *Res. Note Pacif. Nthwest. For. Range Exp. Sta.* No. 179, 1959. pp. 3.

Height growth before and after release was determined by measuring internodes on 49 *Pinus lambertiana* seedlings with a mean height of 3 ft. on partially-cut areas in the South Umpqua drainage system. It was found that seedlings responded with increased height growth after removal of the overstorey; thus modifications in logging and slash-disposal methods in order to save understorey seedlings and saplings have a reasonable chance of being profitable.

4395. Wiant, H. V., Jr., and Walker, L. C. **Mineral spirits effective in hardwood control.** *J. For.* 58 (4), 1960 (324).

A test was initiated in the Georgia Piedmont to determine the usefulness for tree poisoning of mineral spirits marketed as Stoddard Solvent. The liquid was applied in frills during the summer and winter of 1955 and 1956, using ¼ and ½ oz. per 4 in. of girth. Trees treated were 1–12 in. d.b.h. Observations after 3 growing seasons showed that 93% of trees were top-killed, of which 16% had no basal sprouts. Summer applications and the higher dosage gave superior top-kill and less sprouting. Though basal sprouting was excessive, the low cost of this compound ($0·23/gal.) suggests that it could be useful, e.g. in releasing a suppressed crop.

4396. Strang, R. M. **An experiment in bush eradication.** *Rhod. agric. J.* 57 (2), 1960 (122–3). E.M.B.

Trials were made in September 1955 on a 4-acre patch of bush stocked with trees of varying size, mostly *Brachystegia spiciformis*, *Parinari curatellaefolia*, with some *Uapaca kirkii* and *Pterocarpus angolensis* and other, unidentified, species. The following treatments were tested: (1) frill girdling alone; (2) frill girdling with (*a*) 2 lb., (*b*) 3 lb., and (*c*) 4 lb. Ammate per gal. water, applied to the cut surface; (3) Ammate crystals inserted into bark incisions; (4) frill girdling with application of 2,4,5-T at 0·16 lb. acid equivalent (a.e.) per gal. diesoline; (5) basal sprays of 2,4,5-T at the same rate; (6) frill girdling with 2,4-D at 0·16 lb. a.e. per gal. diesoline; (7) basal sprays of 2,4-D at the same rate; and (8) basal sprays of power paraffin. In (2), (3), (4) and (6) trees with d.b.h. < 4 in. were felled and the cut surface treated. The results as recorded in 1959 are presented. (2*b*), (2*c*) and (4) gave very satisfactory and not significantly differing results. None of the other treatments gave much success. (1) was generally more successful than (5), (7) or (8).

245. Tending of Trees, Pruning etc.

See also Nos. 4282, 4432.

4397. Møller, C. M. **The influence of pruning on the growth of conifers.** *Forestry* 33 (1), 1960 (37–53). 23 refs.

The author sifts briefly the principal literature on pruning. He analyses the conclusions reached and in particular, in agreement with Lehtpere on Douglas Fir [cf. *F.A.* 18 No. 4072], disputes the maxim held by some that the removal of up to one-third the length of the live crown has no adverse effect on diameter increment, though he agrees that it may have little effect on height growth. To his analysis of Ladefoged's paper dealing with Norway Spruce [cf. *F.A.* 7 No. 2097], he adds, in a table, his own estimate of the probable % contribution made to stem increment by each of eleven successive whorls of branches from the top downwards and considers that these %s should apply also to young trees of other conifers, given a crown ratio of about 0·6. *From author's summary.*

4398. **Pruning and epicormic branching in Red Alder.** *Extr.* from *Rep. Pacif. Nthwest. For. Range Exp. Sta. 1958*, 1959 (15–7).

Dissection of trunks of *Alnus rubra* pruned 20 years earlier at 21 years of age, showed that pruning scars had healed rapidly, but that development of epicormics seriously hindered the formation of clear wood. Bud strands, originating in the leaf axils, were apparently stimulated by the pruning.

4399. Heiskanen, V. Tutkimuksia koivun karsimisesta. **[Studies on pruning of Birch.]** *Commun. Inst. For. Fenn.* 49 (3), 1958 (1959). pp. 68. 45 refs. [Fi.fi.*e*.]

An examination of knots in 74 Birch stems from 22 stands showed that 452 had been pruned and 593 were probably self-pruned. The knots were analysed in detail, and all defects classified. Experimental peeling of 312 stems from 7 stands pruned in the 1930's was carried out at plywood plants during winter 1955–56. The stems were cut into 64-in. bolts, their diameter and grade determined, and the effect of defects due to pruning was estimated. Grade distribution was considerably better in pruned than in unpruned trees. The value of trees pruned 20–25 years previously was found to be 50–60% higher than that of unpruned trees.

25. Treatment of Defective, Derelict or Very Open Stands

See No. 4376.

26. Combinations of Forestry with Agriculture and Pastoral Husbandry. Irrigated and Floodland Forests, Shelterbelts etc., and their Treatment

4400. Brockway, G. E. **Tree establishment in the wheat belt.** *Bull. Dep. Agric. W. Aust.* No. 2616, 1959. pp. 21.

Examines the problems of establishing trees mainly for cover, recreation, and fodder in semi-arid areas in W. Australia, and includes a comprehensive tabulated planting guide listing the requirements and uses of 44 *Eucalyptus*, 4 *Callitris*, 4 *Casuarina*, and 2 *Acacia* spp., and of *Cupressus arizonica*, *Schinus molle* and *Tamarix articulata*.

261. Alternate Forestry and Agriculture, Periodic or Temporary Agricultural Use of Forest Land

See also No. 4675.

4401. Walter, M. Waldfeldbau im St FB Nedlitz. **[High forest with field crops in the State forest unit of Nedlitz.]** *Forst u. Jagd* 10 (4), 1960 (151–3). [G.]

Describes the formation of Pine plantations, after full cultivation, along with biennial rye and lupins; of Poplar, Ash and Oak plantations in river floodplains along with potatoes and other root crops; and of various plantations with tobacco. In all cases the growth of the plantation was excellent, with great savings in tending costs. All agricultural crops yielded a profit.

4402. Watters, R. F. **The nature of shifting cultivation. A review of recent research.** *Repr.* from *Pacific Viewpoint, Wellington* 1 (1), 1960 (59–99). 102 refs.

A broad survey of systems as practised in Asia, Africa, and, in particular, Indonesia and the Pacific, distinguishing many subdivisions and discussing factors of environment (particularly soil fertility and topography), culture, population densities etc. The system is seen as an ecological climax under certain tropical conditions, only destroyed by the impact of the West with its changing values, rising populations etc. The effect of the system on natural vegetation is only lightly touched upon.

262. Fuel and Fodder Forests

See also Nos. 4983–4.

4403. Silva, J. M. Barata da. O problema das lenhas nas zonas do chá. **[The fuelwood problem in the [Mozambique] tea-growing zones.]** *Gazeta do Agricultor, Lourenço Marques* 11 (119), 1959 (99–106). [Port.] C.G.B.

The answer to the fuel problem in the tea-growing areas of the upper Zambesi in Mozambique is considered to be the establishment of Eucalypt plantations. Considerations are presented on the climate and soils of the region, practical instructions are given for raising plants and establishing and tending plantations, the present situation is briefly reviewed, and specific recommendations are made for species to be used by individual undertakings in Socone, Gurué Milange and Tacuane.

263. Irrigated Forests. Forests subjected to Flooding or Seepage (*Auewald*)

See No. 4248.

264. Farm Forests

See No. 4223.

265. Strips or Lines at Road, Rail and Canal Sides etc.; Hedgerow Trees

4404. Grabhorn, R. Baumreihen als Hochwasserschutz. **[Tree rows as protection against floods.]** *Suppl.* to *Holzzucht, Reinbek* 14 (2), 1960. [G.]

Describes how a row of various Black Poplar hybrids, planted just outside the dykes of a low-lying island in the river Weser near Bremen, reduced damage to the dykes by breaking the force of waves and holding back drifting matter and ice. At 10 years the trees, which are flooded up to 80 times a year (including 5–15 times each summer) have d.b.h.'s of 30–35 cm. The dykes have not been damaged by the roots.

266. Shelterbelts, Windbreaks

See also Nos. 3985–6, 4108, 4539, 4541.

4405. Kitin, B. P. Opităt po săzdavane na polezaštitni gorski pojasi v Južna Dobrudža. **[Creation of shelterbelts in the S. Dobruja.]** *Naučni Trudove, Agronomičeski Fakultet, Visš Selskostopanski Institut "G. Dimitrov", Sofija* No. 7, 1959 (209–56). 21 refs. [Bulg.russ.f.] I.M.I.

An account of investigations on height and volume increment, root development etc. of trees in shelterbelts established by the Rumanian authorities in 1936–40. It appears that pure *Robinia pseudoacacia* belts are generally unsuitable, but belts of Robinia mixed with *Gleditsia* sp. are satisfactory; belts with 3 or 4 main tree species are unsatisfactory; *Ulmus pumila* var. *arborea*, *Gleditsia* sp., Robinia and *Fraxinus excelsior* are suitable species, and *Populus* × '*canadensis*' and *Sophora* sp. are not.

4406. Pavlovskij, E. S., *et al.* Diagonal′no-gruppovoj sposob posadki lesnyh polos. **[A diagonal-group method of laying-out shelterbelts.]** *Vestn. sel.′-hoz. Nauki, Moskva* 5 (5), 1960 (120–3). [Russ.e.g.f.] O.W.

Shelterbelts were planted on an experimental scale (12 ha.) in 1955 by this method (illustrated), which is thought to be superior to row planting for this purpose since it allows mechanized tillage within the belt for a longer period. The experiment has not yet been in operation long enough to allow definite conclusions to be drawn.

4407. TODOROV, T., and BLĂSKOVA, D. Vărhu vlijanieto na polezaštitnite gorski pojasi na mikroklimata. **[The influence of shelterbelts on the microclimate.]** *Naučni Trudove, Agronomičeski Fakultet, Visš Selskostopanski Institut 'G. Dimitrov', Sofija* No. 6, 1959 (103–52). 35 refs. [Bulg.russ.e.] I.M.I.

Graphs and tabulates data on the influence of shelterbelts in the Dobruja area of Bulgaria on wind speed, air temperature, r.h., moisture deficit, evaporation, yield of winter wheat, and snow distribution. The best conditions are created by belts with a low underwood, and 35–45% permeability evenly distributed along the belt but rather more open in the lower part. Main belts should be 400–600 m. apart, and secondary belts as close together as is compatible with the demands of mechanized agriculture.

4408. **[The efficiency of coastal shelterbelts in the N. part of Kiangsu province (1958–59).]** *For. Sci., Peking* 1960 (2), (77–93). 8 refs. [Chin.russ.]

Shelterbelts were found to be effective for distances 10–15 times their height, reducing wind speeds by 17·4–27·28%, but their influence on air temperature, r.h., and soil moisture content in the fields protected was small. At a distance from a shelterbelt of 5–10 times its height, cotton germinated 2–3 days earlier than in the open, grew 5·2–19·86 cm. taller, flowered 4–5 days earlier, fruited more heavily, and gave fibre yields 1·62–3·14% greater.

268. Pastured Forests. Grazing on Forest and Open Ranges. Forage Plants etc.

See Nos. 4547–8, 5210–12.

27. Arboreta. Arboriculture for Ornamental Purposes. Hedges and Hedge Plants

See also Nos. 4108, 4560–1.

4409. SILEN, R. R., and WOIKE, L. R. **The Wind River Arboretum from 1912 to 1956.** *Res. Pap. Pacif. Nthwest. For. Range Exp. Sta.* No. 33, 1959. pp. 50 + 1 map. 16 refs.

Describes the arboretum, its location (near Carson, Washington) and climate, history and recent acquisitions, and analyses the performance of tree species, predominantly coniferous, that have been tried. Of the 165 coniferous species, 42 have died, and another 17, though living, are obviously unsuited to the habitat. These are listed and the known causes of failure given. [Cf. *F.A.* 10 No. 14.]

4410. De beplanting van wegen. **[Roadside plantings.]** Centrum voor Landbouwpublikaties en Landbouwdocumentatie, Wageningen. 1959. pp. 2. [Du.]

A bibliography of ca. 30 references, mainly from Netherlands literature since 1930.

4411. YASHIRODA, K. **Bonsai. Japanese miniature trees. Their style, cultivation, and training.** Faber and Faber Ltd., London. 1960. pp. 116 + 118 photos. 6 refs. Price £1. 10*s*.

28. Husbandry of Forest Products Other than Wood

281. Christmas Trees

4412. LENTZ, A. N. **Growing Christmas trees in New Jersey.** *Extension Bulletin, Extension Service, College of Agriculture, New Brunswick* (*n.s.*) No. 323, 1959. pp. 16. 1 ref.

Advice on: choice of species; buying seedlings; planting; pruning; pest and weed control; harvesting and marketing; and reduction of fire hazard from cut trees or boughs.

282. Bark Crops

See Nos. 4106, 4266.

283. Fruit and Seed Crops etc.

4413. SOMAIAH, M. Note sur les plantations d'*Anacardium occidentale* (Cashewnut) dans la province de Mysore (India). **[*A. occidentale* plantations in Mysore.]** *Bois For. Trop.* No. 70, 1960 (22–4). [F.]

Indicates methods and costs of establishing and tending the plantations.

284. Crops Tapped for Exudations etc.

See also Nos. 4101, 4430.

4414. OLOVENIKOV, G. B. Ogibajuščij vzdymočnyj hak No. 6. **[The No. 6 hack.]** *Gidrol. lesohim. Prom.* 12 (2), 1959 (23–4). [Russ.] P.R.

An improved model of the No. 5 hack [see *F.A.* 20 No. 4603].

4415. KAMIŃSKI, E. Żywicowanie w Chinach. **[Resin tapping in China.]** *Las Polski* 33 (11), 1959 (19–20). [Pol.]

A brief review of information culled from unspecified American and Chinese sources. It covers species tapped (*Pinus massoniana* and *P. tabulaeformis*); method of tapping; oleoresin, rosin and turpentine production (1950–56); and exports.

4416. STEPHAN, G. Untersuchungen auf dem Gebiete der Rohbalsamgewinnung an *Pinus silvestris*. **[Resin-tapping investigations on *P. sylvestris*.]** *Wissenschaftliche Zeitschrift der Humboldt-Universität zu Berlin* (*Mathematisch-Naturwissenschaftliche Reihe*) 7 (5), 1958 (669–78). 6 refs. [G.g.russ.e.f.]

No differences in mean yield and quality were found in trials on 50 trees when one of two faces on the same tree was covered with a special paper after making the cut. It had been thought that protection from atmospheric influences would increase flow by preventing a reduction in the moisture content of the wood (and hence of the pressure) surrounding the resin ducts, and would also reduce evaporation of the turpentine. Covering the gutter and the collecting vessel did reduce evaporation of the turpentine.

4417. FLOTYŃSKI, J. Wyniki stosowania 45% kwasu siarkowego jako bodźca chemicznego przy żywicowaniu sosny pospolitej (*Pinus sylvestris*). **[Results of using 45% H_2SO_4 in tapping Scots Pine.]** *Sylwan* 104 (2), 1960 (41–56). 21 refs. [Pol.russ.e.]

During May 1958, 2802 faces were tapped in the normal way (i.e. without any stimulant). From June to Oct. half the faces (*a*) were tapped by the ordinary method (no stimulant) with freshenings every 3 days; the other half (*b*) were freshened and sprayed with the acid every 7 days. In both cases the ascending ribbed face [cf. *F.A.* 20 No. 4601] was used, rib width being 4–5 mm. in (*a*), and 50 mm. in (*b*). Total yields were more or less the same for (*a*) and (*b*), though (*b*) had only half the number of freshenings, which enabled one worker to look after twice as many faces as with method (*a*).

4418. JUSJUS, A. Opyt povyšenija vyhoda živicy pri podsočke. **[A trial to increase resin yields in tapping.]** *Gidrol. lesohim. Prom.* 12 (2), 1959 (22–3). [Russ.] P.R.

Describes very briefly a trial in 1958 at Kaunas, where a solution of K_3PO_4 was used to stimulate Scots Pine trees on which the upper part of the face was tapped with the ascending ribbed faces and the lower part [in the ordinary way?] using $CaOCl_2$. When K_3PO_4 was introduced into the sapwood, resin yield was increased by 17%; when into the cambium, yield was increased by 36%.

4419. ENČEV, E., and KOSTOV, P. Vlijanie na smolodobivaneto vărhu fiziko-mehaničnite svojsta na dărvesinata na belija i černija bor. **[The influence of resin tapping on the physical and mechanical properties of *Pinus sylvestris* and *P. nigra*.]** *Nauč. Trud. Lesoteh. Inst., Sofija* No. 7, 1959 (221–35). 7 refs. [Bulg.g.]

Statistically evaluated investigations were made on (*a*) three trees of each species, tapped for 8–9 years, with ascending [German?] faces and on (*b*) untapped controls, otherwise comparable. The trees were at 1200 m. alt., d.b.h. 32–46 cm., height 16–20 m., and age 61–98 years. Density of the wood directly under the face (u.f.) exceeded that at the side of the face (s.f.), by 8% in *P. sylvestris* and 13% in *P. nigra*. Wood density of (*a*) exceeded that of (*b*)—by 15·5% in *P. sylvestris* and 21·5% in *P. nigra* for u.f. and by 7% in both species for s.f. Compression strength of u.f. was 7% less in *P. sylvestris* and 3% less in *P. nigra* than that of s.f. Compression strength of (*a*) exceeded that of (*b*)—by 4·6% in *P. sylvestris* and 4·7% in *P. nigra* for u.f., and by 12·5 and 7·2% respectively for s.f. Similar tendencies were found for tensile strength, and static and impact bending strengths, in both species, i.e. wood u.f. was weaker than wood s.f. and wood of (*a*) was stronger than that of (*b*).

4420. GIORDANO, G. Influenza della resinazione sulle caratteristiche del legno di *Pinus pinea*. **[The effect of resin-tapping on the wood properties of *P. pinea*.]** *Ann. Accad. Ital. Sci. For.* 8, 1959 (147–63). [It.f.]

A study was made of comparable samples from (*a*) 8 tapped (for 3 seasons) and (*b*) 8 untapped trees from the same plantation. No difference was observed in sp. gr., and the slight differences in compression and bending strength between (*a*) and (*b*) were not significant; (*b*) wood showed slightly greater resistance to impact than (*a*).

4421. MESSERI, A. Contributo alla conoscenza dei meccanismi anatomici e fisiologici della resinazione. I. Alterazioni anatomiche in legno resinato e tamponato di *Pinus pinea*. **[The anatomical and physiological mechanisms of resin-tapping. I. Anatomical changes in tapped and plugged wood of *P. pinea*.]** *Ann. Accad. Ital. Sci. For.* 8, 1959 (203–25 + 8 plates). 17 refs. [It.f.]

Describes the results of anatomical observations on two trees of *Pinus pinea*, ca. 80 years old, tapped simultaneously by ascending faces starting at about 1 m. from ground level, fresh streaks being made every 5 days during June to July. In tree (*a*) resin was allowed to run down into a cup in the usual way. In tree (*b*) the streaks were plugged as soon as cut, so that not more than a few drops of resin could exude from the wound. Samples of wood were taken from both trees in the following January, (1) at 20 cm. above, and (2) on a level with, the highest streak, and (3) on a level with, and (4) 20 cm. below, the lowest streak. It was found that the wounding had caused anatomical changes in both trees. The differentiation of traumatic secretory canals occurred only at (2), which were made in July at the period when resin canals differentiate spontaneously. The woody tissue surrounding the faces was more or less soaked with resin, this being more abundant at the lower levels and more evident in (*b*) than in (*a*); this resin came almost exclusively from the radial canals; early and late wood were equally effected. Examination of normal longitudinal canals reached by the wounds showed two types of reaction: in (*a*) they were obstructed by tylosoids formed in the interior of the canal; in (*b*) the resin canals were distinctly elongated tangentially with the orifice divaricated. The bearing of these anatomical changes on the secretion and exudation of resin is discussed.

4422. MESSERI, A., and SAYA, I. Contributo alla conoscenza dei meccanismi anatomici e fisiologici della resinazione. II. Localizzazione della resina e turgore cellulare da ferita. **[The anatomical and physiological mechanisms of resin-tapping. II. Localization of the resin, and cellular turgescence after wounding.]** *Ann. Accad. Ital. Sci. For.* 8, 1959 (227–36 + 2 plates). 8 refs. [It.f.]

Further study confirmed the fact that, in intact longitudinal canals, the resin is always contained in the resiniferous cells and never runs into the lumen. In canals interrupted by traumatic lesions, on the other hand, the secretory cells react in one of two ways; either by turgescence, which tends to immobilize the resin in the cytoplasm; or in the following sequence of processes—the resin emulsifies in the cytoplasm, the vacuole disappears, the nucleus degenerates, the cell membranes thicken and turn into lamellae, the pits enlarge, and the resin exudes through them into the lumen. It appears that only those cells that react in the second fashion are able to feed the flow of resin from a wound.

4423. Štanagej, V. G. Podsočka eli. **[Tapping Spruce.]** *Gidrol. lesohim. Prom.* 11 (7), 1958 (28–30). 4 refs. [Russ.russ.] P.R.

Experimental tapping was done by 5 variants of the CNILHI method (i.e. removal of a broad (1·2–1·4 m.) band of bark to form a "face" round the tree, and collecting the resin for one season only, before felling). Ten trees were tapped per variant, and data are tabulated on the time taken to cut these faces, and on yields. In further investigations on a production scale (300 trees per variant), two variants of the CNILHI face were compared: (*a*) with only the outer and inner bark removed, and (*b*) with the cambium also removed. Resin yield from (*a*) was 95·6, and from (*b*) 76·1 kg. Under these field conditions, yield per tree was 121 g. less than in the experimental tappings, and labour costs in cutting the faces and collecting the resin were, per unit weight of resin collected, almost the same as in tapping Pine.

286. Osier-Growing

See Nos. 4217, 4445.

287. Bamboo and Cane Growing etc.

4424. **[Investigation of the high yield of *Phyllostachys edulis* in the Shihmen region of Szechwan Province.]** *For. Sci., Peking* 1959 (3), (161–71). [Chin.russ.]

Describes the intensive culture practised—manuring (cow and pig), weeding, protection, controlled harvesting—and tabulates data on production, including mean culm and branch dimensions, yield (weight) per mu [0·152 acre], and on strength properties.

288. Crops Grown for Animal Products

4425. Krishnaswami, S., Purkayastha, B. K., and Chauhan, N. S. ***Moghania macrophylla* (Willd). O. Ktze. (syn. *Flemingia congesta* Roxb. var. *semialata* Bak.) as a new lac host for growing the *Kusmi* strain of the lac insect.** *Curr. Sci.* 28 (10), 1959 (419–20). 3 refs. A.P.B.

Moghania macrophylla, a tall leguminous shrub, is being grown experimentally by the Lac Research Institute, Namkum, and is being inoculated with the *Kusmi* strain of the lac insect. Possibilities of obtaining good lac yields from artificial stands of this species are promising.

4426. Smith, F. G. **Beekeeping in the tropics.** Longmans, London. 1960. pp. 265 + 69 photos. 154 refs. Price £2. 5*s*. O.R.E.

Includes chapters on: Bee forage (indicating the value of the main tropical vegetation types, and of plantation and farm crops along with their weeds, and enumerating objectionable forage species); Management of primitive hives; and Honey from primitive hives. Appendices include addresses of beekeeping associations in the tropics, and there is an extensive bibliography.

3. WORK SCIENCE (WORK STUDIES). HARVESTING OF WOOD: LOGGING AND TRANSPORT. FOREST ENGINEERING

30. Work Science (Work Studies): General

See also Nos. 4803, 4818.

4427. Sonderheft "Geffa-Tagung". **[Special number: Meeting of the Forest Work Study Society.]** *Forst- u. Holzw.* 15 (9), 1960 (169–85). Many refs. [G.]

A collection of papers: Reducing costs by rationalizing work in forestry (*Rupf*; *Kriebitzsch*; *H. Kennel*); Reducing costs in private forests in Hessen-Nassau by rationalization with the aid of progressive techniques (*H. Schleicher*); Correct felling of trees with power saws (*H. H. Hilf*) [an illustrated account of correct felling methods]; Piece-work wages with machines owned by forest workers? (*H. Steinlin*); Can the present crisis in German forestry be overcome by rationalization and mechanization alone? (*H. Gläser*); Training schools for forest workers (*E. G. Strehlke*).

4428. **Secretariat report on the enquiry on forest working techniques and training of forest workers in the region (March 1959); regional programme of action.** [*Docum.*] *5th Sess. FAO Asia-Pacif. For. Comm. Wkg. Party on Forest Working Techniques and Training of Forest Workers, New Delhi 1960* Nos. *FAO/APFC/FWT* 60/4.1, *FAO/APFC/FWT* 60/5.1 plus *Suppl.* 1, 1960. pp. 17 + 3. Limited distribution.

Summarizes replies to a questionnaire received from member countries in the Asia-Pacific region on organization of exploitation; working methods and tools in logging; short- and long-distance transport; labour force, training of workers and supervisory personnel, research, and unsolved problems, and makes recommendations based thereon.

4429. Mit den Gegebenheiten fertig werden! **[Adapting oneself to existing conditions [of the labour market and the market for wood].]** *Forsttech. Inform., Mainz* 1960 (5/6), (31–44). [G.]

A special number on rationalization (which comprises mechanization, work studies, operations research etc.) based on the 1960 meeting of GEFFA [Gesellschaft für forstliche Arbeitswissenschaft] at Bad Münster, including articles by: *H. H. Hilf* on the "possibility guide", an American work-science technique, *H. Steinlin* on the effect of mechanization on the seasonal distribution of forest work, size and specialization of the labour force, optimum size of forest districts, and the training and specialization of forest officers, and *Platzer* on rationalization and the forest worker, with some German data on the increase in productivity and worker's earnings.

302. Man and Work (Physiology and Psychology)

4430. Schilling, W. Physiologische Begründung arbeitsökonomischer Entscheidungen. **[The**

physiological basis of decisions in the field of work economics [rate fixing].] *Forst u. Jagd* 10 (4), 1960 (177–9). [G.]

Discusses the need for physiological investigations to ascertain calorie consumption and other indicators of effort involved, for determining fair standards of performance per shift, rest periods, suitability of certain jobs for women, etc. Examples are given from resin-tapping (influence of position when cutting faces, kneeling, bending, standing, or balancing on a trestle), making planting holes, power-sawing on level or sloping sites, and barking Spruce at different times of year. [Cf. *F.A.* 21 No. 1838.]

304. Hygiene; Accidents and their Prevention

See also Nos. 4446, 4885, 4935–6, 4951.

4431. KAMINSKY, G. Lärm und Erschütterung —zwei beachtenswerte Beanspruchungen bei der maschinellen Forstarbeit. **[Noise and vibration—two serious causes of strain when using machines in forest work.]** *Forstarchiv* 31 (4), 1960 (33–6). 13 refs. [G.]

Discusses human tolerance of noise and vibration, points out the potential danger to the worker of machinery used in forestry, and suggests that health as well as performance should be considered when choosing or designing power saws.

307. Tools, Equipment, Machines and Working Animals: General

See also Nos. 4277, 4287, 4309, 4317, 4320–1, 4345–7, 4360, 4414.

4432. **Equipment section.** *Unasylva* 14 (1), 1960 (46–8).

Includes descriptions, specifications, and photographs of: the Santilli annular saw (Seghe Anulari Santilli, Turin) [40-cm. annular saw suitable for felling trees and cross-cutting logs up to 60 cm. diam.]; Cross-cut saw machine (Tyson's, Ulverston, Lancs.) [designed for sawing to length, and squaring, blank ends suitable for automatic lathes etc.]; Tarpen Little Giant chain saw (Tarpen Engineering Co. Ltd., London) [designed for pruning, it can be used single-handed from a ladder or in the tree, and cuts branches 4 in. (10 cm.) thick]; Jungle Buster Tree Crusher (R. G. LeTourneau Inc., Longview, Texas) [electric tree crusher designed specifically for removing unproductive forests]; Johanson-Chej barker (C. H. E. Johanson A/B, Nova Stad, Sweden); log splitter (Waco Aircraft Co., Troy, Ohio); 'Smith' circular framesaw (Smith & Schneider, Chinook Valley, Alberta); DeRouen Dendrochronograph (DeRouen Machine Works, Trinidad, Colorado) [developed for tree-ring measurement].

4433. **Equipment section.** *Unasylva* 13 (4), 1959 (217–9).

Includes descriptions, with photographs and specifications, of: the Hydraulic Chain 5-ton Mobile Crane (International Harvester Co. of New Zealand, Ltd., Christchurch, N.Z.); Porter Cable Model 533 (Porter-Cable Machine Co., Syracuse, New York) [an adaptable 7½-in. saw powered by a 13-amp. motor]; Heavy-duty attachment for Caterpillar No. 955—Traxcavator (Caterpillar Tractor Co., Peoria, Ill.) [handling logs of 72 in. diam.]; Slice-O-Lator (M. and W. Iron Works Inc., Deerfield Beach, Florida) [a sort of scarifier]; Hyry Chain Saw (Auto Koneistamo Oy, Helsinki, Finland); Automatic Oscillating Curve and Plane Sander (Kurt Ehemann, Spezialmaschinenfabrik GMBH, Delmenhorst, W. Germany); Alber Automatic Band- and Circular-Saw Sharpening Machine (Rudolf Alber, Ebersbach-Fils, W. Germany).

4434. Maschineneinsatz im Forstbetrieb. Technische Grundlagen—wirtschaftliche Voraussetzungen. **[Mechanization in forestry. Technical and economic aspects.]** *Forsttech. Inform., Mainz* 1959 (3; 4; 9; 12), (9–26; 27–36; 65–72; 89–100). 60 refs. [G.]

A series of articles by different authors, planned to cover machines for all types of forest work, and the work organization, costs, etc. involved. Articles in 1959 covered the clearing of planting sites (including hand power-tools for weed control, stump clearing, drainage and plant-hole boring), power saws and portable circular saws.

4435. LETOURNEUX, C. Utilisation de matériel mécanique pour les plantations forestières tropicales. **[The use of mechanical equipment in tropical forest plantations.]** *Bois For. Trop.* No. 71, 1960 (19–40). [F.e.span.]

Covers most of the ground of Chap. 3 of the author's monograph on tropical plantations [cf. *F.A.* 21 No. 2935].

31. Logging and Transport: General

4436. LUSSIER, L. J. **Use of operations research in determining optimum logging layouts.** *Pulp Paper Mag. Can.* 61 (Convention No.), 1960 (280 . . . 289). [Cf. *F.A.* 21 No. 1847.]

32. Felling and Related Operations

322. Felling Season. Preparatory Measures

See also Nos. 4498, 5051, 5061.

4437. HEISKANEN, V., and HAKKILA, P. Polttohakepuun kuivuminen rasissa vuoden 1959 kokeiden tuloksia. **[The drying of wood for fuel chips, felled in summer and left with crowns intact: results of experiments in 1959.]** *Metsät. Aikak.* 1960 (4), (154–9). 3 refs. [Fi.e.*e.*]

In a study carried out in 5 districts of S., central and N. Finland, 30–50 trees, d.b.h. 3–14 cm., of Pine, of Spruce and of Birch were felled in each district at monthly intervals from Nov.–Dec. 1958 to Sept.–Oct. 1959 and left to season with crown intact ['sour felling'], whereas controls from S. Finland were trimmed and cross-cut immediately, to give long logs of small diameter, and stacked in the forest. Moisture content was determined at intervals during the seasoning period and finally in Nov. 1959 at ¼, ½ and ¾ stem height. Results, probably representing rather better drying conditions than usual because of the warm, dry summer, may be summarized as follows: (1) sour felling gave better drying than immediate trimming and cross-cutting; (2) Spruce dried considerably better than Pine or Birch; (3) the effect of diameter on drying, for both sour felling of coniferous (but not of Birch) wood and for long logs of all species, was considerable; (4) sour-felled wood felled in summer and long logs felled in autumn before the first snowfall dried more slowly during the next summer than trees felled during winter; (5) to ensure maximum drying, sour-felled Pine should be felled by June–July, Spruce by July and Birch by August–September, and long logs of all species by June.

4438. Strehlke, B., and Peine, J. Wurzelanläufe vor oder nach dem Fällen abschneiden? **[Should butt swellings be cut before or after felling?]** *Allg. Forstzeitschr.* 15 (17), 1960 (260–2). [G.]

Tests with various power-saws on 212 stems (Spruce or Beech of 30–60 cm. d.b.h.) confirmed that it was more economic, in terms of cutting area, time, and chain wear, to cut the butt swellings off the felled stem on the ground [cf. *F.A.* 21 No. 3214]. Moreover, their removal before making the felling cuts, though admittedly easier for the less experienced worker, is less safe in cases of hidden butt rot or where wedges are unexpectedly called for.

323. Felling and Subsequent Primary Conversion

See Nos. 4427, 4430, 4446–53, 4468–9, 4472, 5051.

325. Sorting and Assortments of Wood in the Rough

4439. Meyer-Brenken, H. Begriff und Aushaltung des C+-Holzes bei Fichte. **[The C+ timber assortment [of the German HOMA] and its production by rational cross-cutting in Spruce.]** *Holz-Zbl.* 86 (57), 1960 (801–3). 2 refs. [G.]

In stands in the Harz mountains ca. 25% of the wood cut was of the C+ grade, "diseased stem wood" (with or without other defects), distinguished in many German states from C grade, i.e. sound stemwood having serious defects. The % (frequently in butts of deer-damaged trees) rose with age and site quality. Analysis of 8 stems of B quality, from which C+ logs of a mean length of 4·5 m. had had to be cut, containing 17% of their length and 29% of their volume, showed a reduction of 14% in their value. In veneer-quality logs it is best to cut off the rot-damaged part (using it as cordwood) so as to produce a shorter, B-quality butt log. In other cases it is more economic to cut C+ logs.

33. Degree of Utilization and Waste. Clearing the Felling Site. Harvesting of Small Wood. Salvage Fellings

See also Nos. 4235, 4277, 4432, 4434, 4468, 4498, 4531, 4613.

4440. Namise, N., *et al.* **[Study on easy stumping with the assistance of wood-rotting fungi.]** *J. Fac. Agric. Iwate Univ.* 4 (2), 1959 (192–226). 9 refs. [Jap.e.*e*.] O.R.E.

A 3-year investigation on the inoculation of stumps of (1) *Larix leptolepis*, (2) *Pinus densiflora*, (3) *Quercus* spp., and (4) *Abies mayriana*, with 12 species of fungus (all obligate saprophytes) so as to accelerate and facilitate stump removal. Data are presented, with diagrams and photos (some in colour), on the conditions of fungal growth, penetration of mycelia, degree of decay, the physical power required to uproot the stumps, and the physical and mechanical properties of test pieces taken from sound and artificially decayed areas. The best fungi to use were: *Poria subacida* on (1); *Poria vaporaria* and *Steccherinum* [*Hydnum*] *pulcherrimum* on (2); *Coriolus* [*Polystictus*] *versicolor* and *Tyromyces* [*Polyporus*] *sambuceus* on (3). A 30-cm.-diam. stump of (2) normally takes 6–7 years before it decays sufficiently to be easily uprooted, while inoculation treatment with *Poria vaporaria* cuts this to 2–3 years: similarly *Poria subacida* on (1) cuts the time from ⩾ 10 to 3–4 years. In the third year after inoculation with the *Poria* spp., the power required to uproot a stump is ca. 40% less than with non-inoculated control stumps.

34. Storage of Wood in the Forest and at Log Dumps ("Landings")

See Nos. 4487, 5051, 5062–8.

35. Performance Measurements for Determining Piece Rates in Felling and Related Operations

See also Nos. 4377, 4427, 4447–8.

4441. Pettersson, E., and Staaf, A. Utredning angående prestationsförändringen i huggningsarbetet under perioden 1951–1958 vid Katrinefors AB. **[Changes in performance in logging work with the Katrinefors Company from 1951 to 1958.]** *Svenska SkogsvFören. Tidskr.* 58 (2), 1960 (163–82). 7 refs. [Sw.sw.e.]

On the basis of records of volume felled, man-days worked etc., it is calculated that productivity in felling and primary conversion rose ca. 2·25% a year or ca. 20% over the period. Whereas under existing wages agreements direct costs were not greatly affected, it is computed that indirect costs were lowered by 0·45% of direct felling costs for each 1% increase in productivity (social costs, including housing, are estimated at 3791 Kronor per worker).

4442. Platzer, H. B. Können wir bei der Zeitstudie (Leistungs-untersuchung) reine Sortenzeiten (Kostenzeiten) erheben? **[Is it possible to determine in work studies the time (cost) applicable to each assortment?]** *Forstarchiv* 31 (4), 1960 (28–9). [G.]

Argues that current methods of apportioning "tree times" (total time required up to and including felling and trimming) and barking times (included in stemwood conversion times) in proportion to cubic volume, distort production costs in favour of the smaller assortments, and suggests methods of time study by stem and branch sections or by assortments, so as to ascertain, for example, the marginal profitability of producing cordwood.

4443. Bernhart, A. Leistungsuntersuchungen beim Treiben von Blochholz. **[Investigations on output in handling logs with *sappis*.]** *Forstwiss. Cbl.* 79 (5/6), 1960 (140–57). 9 refs. [G.g.]

Gives the findings of time studies, totalling 58·5 hours, of operations at two different sites in Upper Bavaria, one a Spruce/Silver Fir stand with middle storey Beech and Maple, the other a Spruce/Fir/Beech stand.

4444. Cunia, T. **Production studies in cutting and horse skidding.** *Pulp Paper Mag. Can.* 61 (5), 1960 (178, 180, 184, 186).

Describes the procedure in analysing felling and skidding performance on the Canadian International Paper Co.'s limits in the last 7 years.

36. Tools, Machines and Equipment for Felling and Related Operations

See also Nos. 4277, 4430–4, 4466, 4491, 4951.

4445. Botwin, M. Rozvój mechanizacji korowanie wikliny. **[Development of mechanical barking of osiers.]** *Las Polski* 34 (1), 1960 (16–7). [Pol.]

Discusses various types of osier barkers, and describes and illustrates the design of a two-drum Polish machine.

4446. Loycke, H. J. Vergleichende Untersuchungen an Einmann-Motorsägen. **[Comparative tests on one-man power saws.]** *Holz-Zbl.* 86 (52), 1960 (743–6). 4 refs. [G.]

Describes trials in the laboratory and field with 8 [unnamed] geared (*a*) and gearless (*b*) power saws, giving technical and performance data with Spruce and Beech of varying dimensions, etc. Cutting performance of (*b*) was markedly better than that of (*a*) for equal cylinder capacity, in terms of min./sq. m. and in terms of worker's effort expressed as kg. (of saw weight) × sawing time/sq. m. and, though somewhat inferior in terms of sq. m./h.p. ratio and fuel consumption/hour, was about equal in area cut per litre of fuel and oil consumed. All saws tested were so noisy (99–114 phons were measured in the forest) that, because of the health hazard, the full approval of the testing station, viz. "suitable and recommended for forestry use", was withheld. [Cf. *F.A.* 21 No. 3214.]

4447. Hilscher, A. Arbeitsleistungen beim Einsatz der Einmann-Motorsäge. Bericht über Zeitaufnahmen im Nadelholz unter günstigen Bedingungen. **[Output of the one-man power saw. Report on time requirements with conifers under favourable conditions.]** *Forstarchiv* 31 (4), 1960 (30–3). 3 refs. [G.]

Reports on time and cost studies in Carinthia with a 2-man team using a Stihl BLK to produce 91·83 cu. m. of Spruce logs 4 m. long with a mean mid-diam. of 24 cm. These confirmed findings reported earlier [cf. *F.A.* 21 No. 538] that power-saw times were so short (11·78% of total working time, viz. 3·58% for felling, 3·18 for cross-cutting and 5·02 for trimming) that, despite savings in sawing time as compared with hand sawing of ca. 27%, the financial result is small and the economic employment of saws under these conditions difficult.

4448. Makkonen, O. Moottorisaha tukkien teossa vertaileva työntutkimus. **[Power saws in the preparation of sawlogs: a comparative work study.]** *Tied., Metsäteho, Helsinki* No. 170, 1960. pp. 20. [Fi.*e.*]

Presents results of a preliminary study, similar to that already made with pulpwood [see *F.A.* 21 No. 1862]. General conclusions are that, with a 2-man gang and a suitable division of work between them, there may be a saving of ca. 45% of total working time over hand sawing, in preparing unbarked, unstacked Pine, and of 37% in preparing Spruce. The saving for one-man working may be 30–35% (Pine) and 25–30% (Spruce). The time spent in handling bolts rejected because of rot, and in removing rot-damaged butts was considerably reduced. *From author's summary.*

4449. Fischer, D. Motorsägen-Statistik. **[Power-saw statistics.]** *Allg. Forstzeitschr.* 15 (17), 1960 (258–9). [G.]

Summarizes an inquiry conducted by GEFFA [Gesellschaft für Forstliche Arbeitswissenschaft] on the position in W. Germany as at 1.1.1959. Of a total of 7825 one-man and 3193 two-man saws, 80% were owned by the workers, nearly half of whom had received some financial assistance. More than half of all saws had been purchased since 1955, and < 6% were of foreign make. Württemberg and Hesse (states with large forests containing much hardwood) had most power saws (> 3/1000 ha. or 1/1300 cu. m. annual cut) and Bavaria (mostly conifers) fewest (1/4000 ha. or 1/12,300 cu. m.).

4450. Kanev, N. F., Baranov, A. M., and Aliev, I. S. Motorizovannyj instrument dlja lesokul′turnyh rabot. **[A powered hand-tool for plantation work.]** *Lesn. Prom.* 1960 (3), (23–7). [Russ.]

Describes, with diagrams and specifications, a plant-hole borer, a soil scarifier, and a disk weeder, developed by VNIILM as attachments for standard Soviet power saws in place of the blade. [Cf. *F.A.* 18 No. 379.]

4451. **Chain saws and benches.** *Farm Mechanization, London* 12 (128), 1960 (139–41). O.R.E.

Lists in two tables the chain saws and saw benches available on the British market, giving the manufacturer or supplier, main specifications, size, price, and special features of each.

4452. Poliščuk, A. P., Šiškin, A. G., and Šmakov, D. K. Gidravličeskij klin. **[A hydraulic wedge.]** *Lesn. Prom.* 1960 (5), (10–1). [Russ.]

A full description (with specifications) of the wedge [see *F.A.* 21 No. 535].

4453. Ein neues Stammhebe- und Wendegerät. **[A new tool for lifting and turning logs.]** *Holz-Zbl.* 86 (33), 1960 (501). [G.]

The tool (illustrated), of German manufacture, consists essentially of an iron lever bent at the bottom into a fixed prising arm, and having a pivoted upper arm to grip the log, turning on a pin fixed to a base plate. The tool weighs 12 kg.

4454. Pardé, J. Une amélioration du griffage en forêt. **[An improvement in blazing in the forest.]** *Rev. for. franç.* 12 (5), 1960 (327–8). [F.]

Describes a small counting device, 3 × 2·5 cm., which can be easily mounted on the handle of a scribe. The user records each tree as he marks it by pressing a lever; counting accuracy is thereby greatly increased. The dial of the device registers from 0 to 999, and can be locked with a small catch if required. The counter, made in W. Germany by D. Dominicus, costs DM 10.65.

372/377. Land Transport

See also Nos. 3948, 3989, 4234–5, 4433, 4444, 4811–4.

4455. KILANDER, K. Hästkörningsarbetets rationalisering. **[Rationalisation of horse-haulage.]** *Skogen* 47 (9), 1960 (190–1). 11 refs. [Sw.sw.]

Discusses loading and unloading, the choice of equipment, and the degree of use of a horse during the year. Includes graphs showing the effect of increasing the size of a load on the volume hauled per day, and of increasing the number of working days on the amount earned by drivers.

4456. HRISTOV, S. Izmenenie na opăvaštite sili v otdelnite meždupodporni razstojanija na noseštite važeta na prenosimata vážena linija 'Visen'. **[Changes in tension stress in the individual skyline spans of a Wyssen cableway.]** *Nauč. Trud. Lesoteh. Inst., Sofija* No. 7, 1959 (159–209). 10 refs. [Bulg.g.] [Cf. *F.A.* 20 No. 4658.]

4457. HRISTOV, S. Formuli za opredeljane provisvanijata na natovarenoto nosešto váže na visjaštata vážena linija 'Visen'. **[Formulae for determining the hang of a loaded skyline in a Wyssen cableway.]** *Nauč. Trud. Lesoteh. Inst., Sofija* No. 7, 1959 (213–8). 2 refs. [Bulg.g.] [Cf. *F.A.* 20 No. 4658.]

4458. MINKOV, N., *et al.* Nomografičesko orazmerjavane na nepodvižno zakotvenoto v dvata si kraja nosešto váže na prenosimata vážena linija 'Visen'. **[Nomograms for determining the dimensions of a Wyssen cableway skyline anchored at both ends.]** *Nauč. Trud. Lesoteh. Inst., Sofija* No. 7, 1959 (265–83 + 5 nomograms). 3 refs. [Bulg.g.]

A fuller version of an earlier paper [see *F.A.* 20 No. 4658].

4459. VINOGOROV, G. Vertolet na lesozagotovkah. **[Helicopters in logging.]** *Lesn. Prom.* 1960 (4), (12–4). [Russ.]

Helicopter logging trials, comprising 66 flights (with load) and 18 variants (distance, load, etc.), were made on two sites at 800–1100 m. alt. in the Caucasus, in Oak and Beech/Fir forests. Assortments, tree-length logs, and whole trees were transported for various distances up to 22 km. The helicopter, a standard MI-4 [see *F.A.* 19 No. 4665], was able to transport from clear fellings and group-selection fellings, but clearings 50 × 50m. had to be made for it in selection forests proper. From the economic standpoint, it seemed desirable to transport assortments only. A single trial was made of attaching cables to the tree before felling, and lifting the whole tree up and away before it could fall to the ground [see *F.A.* 21 p. 334]. This procedure was found to be slow and dangerous and is definitely not to be recommended. Analyses showed that costs of transporting timber for 1·5 km. (15 trips/hr.; 18 cu. m. wood/hr.) were 110 roubles/cu. m.; for 5 km. (7 trips/hr.; 9 cu. m. wood/hr.) 210 roubles/cu. m.; for 20 km. (2 trips/hr.; 2·5 cu. m. wood/hr.) 760 roubles/cu. m. Total transport costs by helicopter at present are 2–6 times those of conventional ground extraction methods. It is thought that helicopters will be effective for extracting relatively small volumes from set areas in mountainous regions where roads are very expensive to build. For forest work, helicopters should be able to take loads of 8–10 tons, and are best for transport distances of 3–8 km.

4460. HORNCASTLE, D. C. **Palletizing in the woods.** *Pulp Paper Mag. Can.* 61 (4), 1960 (204–6, 208). 4 refs.

Reviews the use of pallets in pulpwood handling in Canada, discussing advantages and disadvantages of the method, and giving cost data in graphs.

4461. ALLOUARD, P. Le chargement des grumes dans les exploitations forestières tropicales. **[Log-loading methods on tropical forest sites.]** *Publ. Centre Tech. For. Trop.* No. 13, [1958]. pp. 79. [F.]

The methods described are classified under the following heads: (i) loading from the side; (ii) loading by hoisting and other mechanical lifting devices; (iii) pre-loading by means of tripods, derricks, gyns etc.; (iv) miscellaneous methods, e.g the "Cambodian" method, involving the jacking up of the log on to the rear of the lorry and moving the trailer underneath the log; and the Mexican method of winching up the log between two trees and lowering it on to the lorry.

4462. MCINTOSH, J. A. **How log loading affects utilization.** *Repr.* from *Canada Lumberman, Toronto* Jan., 1960. pp. 4.

To determine the effect on utilization and productivity of such factors as (*a*) log volume, (*b*) yarding methods, (*c*) log length, and (*d*) size of loading gang, studies were made on log-loading methods employing mobile loading units fitted with (i) log grapples, (ii) air-tongs, and (iii) standard loading tongs. Owing to the many variables encountered, such as availability of lorries, log supply, loading conditions at the landing, and operator's experience, comparison of one operation with another was difficult. However, after scaling and recording the gross and nett volumes of the logs, sufficient data were obtained to show the pattern and assess the effects of the various factors, the findings revealing that: (1) all, but especially small log sizes were loaded more economically by methods using (i) and (ii), rather than (iii); (2) the loading capacity of both (i) and (iii) was definitely affected by (*b*), both being most effective on operations where logs were moved by tractor; (3) except on one operation where logs were balanced in the grapple instead of being 'heeled' against the boom, (*c*) was not significant when considered on a unit-volume basis; (*d*) was an important economic and safety factor in using (i) and (ii), since only two men were required vs. three for (iii), and at no time during loading was there a man below or near the logs; (5) for (i) and (ii), a higher degree of operator skill appeared to be an important factor.

4463. KANTOLA, M. Pinotavaran autoonkuormaus-menetelmät. **[Methods of loading cordwood on to lorries.]** *Julkaisu, Työtehoseura, Helsinki* No. 87, 1960. pp. 82. 22 refs. [Fi.fi.e.]

Reviews methods used in different parts of the world, citing mainly N. American, Scandinavian and German literature, and discusses their relevance to conditions in Finland.

4464. **Electric-powered grapple**. *Sth. Lumberm.* 200 (2501), 1960 (54).

The grapple, for use with Le Tourneau electric-powered log loaders or single-line fixed cranes, has a small electric motor and gearbox mounted on it, to operate a cable mechanism that can open the arms to a width of 65 in. or close them completely.

4465. PABLO. Nytt från traktorfronten. **[News from the tractor front.]** *Skogen* 47 (10), 1960 (206). [Sw.]

Includes a photograph and description of the use of a Swedish grab that can be attached to an Allis-Chalmers HD-6G tractor and used either to load stacked logs on to a sledge (then hauled by the tractor to the roadside), or to carry the stacked timber direct to the road and to load it on to the lorry.

4466. V., A. Teknisk nytt i svensk skogbruk. **[Technical novelties in Swedish forestry.]** *Norsk Skogbr.* 6 (7), 1960 (244–6). [Nor.]

An illustrated account of an exhibition of forestry equipment, including tractor trailers and sledges, horse sledges, loading equipment (the Hiab Elefant and the Bolinder remote-control crane), tractors, chippers and sprayers (rucksack, hand and tractor types).

4467. SERVO, M., and TAIPALE, A. Juontokärry m/VAPO-Ahlgrén. **[The VAPO-Ahlgrén drag cart.]** *Metsät. Aikak.* 1960 (3), (105–6). [Fi.]

Describes with illustrations a light cart developed by VAPO (the Fuel Office of the Finnish State Railways) particularly for dragging bundles of thin long logs when there is no snow on the ground.

4468. VASIL′EV, E. A., and KOZUBOV, G. M. Valka i trelevka derev′ev s kornjami. **[Felling and skidding trees with roots.]** *Lesn. Prom.* 1960 (5), (8–9). [Russ.]

In view of the high % of resin in conifer stumps, interest was shown in Karelia in felling and extracting whole trees together with their roots, in order to utilize the stumpwood at the timber depot. Accordingly, a trial was made in a Pine/Spruce stand 160–180 years old, of mean height 19–20 m., standing volume 250 cu. m./ha. The trees were pulled out of the ground individually by S-80 tractors with cables. Some trials were also made in pulling out several trees together. The trees were skidded out by tractor (roots or tops first), in bundles of 5–6, to lorry roads for transport to the timber depot. Each lorry load consisted of some 15 trees (ca. 16 cu. m.). The method is thought to be economic, and it is claimed that after felling in this way, the top layers of the soil are well mixed and very suitable for natural regeneration or for mechanized planting.

4469. GORBAČEVSKIJ, V. A., and LEKSAU, I. N. Valočno-transportnyj poezd CNIIMĖ. **[The CNIIMĖ felling-and-transporting "train".]** *Lesn. Prom.* 1960 (5), (5–6). [Russ.]

The "train" consists of a TDT-60 tractor equipped with a loading jib, and a trailer with a special swivelling support. Trees are felled directly on to this support, and can be drawn into a tidy bundle (ca. 16 cu. m.) by means of the jib and its collecting cable. The train then takes the trees to the lorry road for lorry transport to the timber depot.

4470. KLAR, G. V., and POBEDINSKIJ, A. V. Lesovodstvennaja ocenka novoj tehnologii. **[Silvicultural assessment of the new technique.]** *Lesn. Prom.* 1960 (5), (7). [Russ.]

In order to assess the suitability of the new felling-and-transporting technique [see preceding abstract] from the silvicultural standpoint; investigations were made in a 75-year-old Birch/Aspen/Spruce stand (5/4/1) with a Spruce understorey 15–20 years old. Work was done (*a*) by working into the forest gradually from the margin, and (*b*) by moving along tracks previously made in the forest. Survival of understorey Spruce was only 25·5% by (*a*), and up to 76·6% by (*b*). Accordingly, method (*b*) is recommended on felling areas where there is advance growth.

4471. SHREEVE, F. T., and BIGGAR, J. C. **Bunching of tree lengths and wheel-skidding bunched wood.** *Pulp Paper Mag. Can.* 61 (Convention No.), 1960 (275–6, 278–9).

Describes a trial in Black Spruce swamps (where the timber averaged 15 trees/cord and 14 cords/acre), using a small portable winch for skidding tree-length logs and forming bundles of them, for subsequent transport by wheeled skidding tractor. The trial indicated that the principle has definite possibilities, but the range of application is at present confined to near-ideal conditions (e.g. no undergrowth). Further trials are to be made with a more powerful, portable, radio-controlled winch. Another trial was made on tree-length logs (Jack Pine and Spruce, ca. 10½ trees/cord), using small wheeled skidding tractors to bunch ca. 6 logs and skid them ca. 1000 ft., and then to use bigger wheeled Timberland skidding tractors, each of which hauls up to 40 logs, for the average 1½-mile run to the river landing. Some details of operating costs are given. This wheeled skidding of tree-length logs proved to be an advantageous method in rough, broken country and relatively sparse stands of small trees.

4472. VIT, R. **Development of a feller buncher skidder for full tree logging operations**. *Pulp Paper Mag. Can.* 61 (Convention No.), 1960 (270–2, 274).

A prototype unit, the VFB [not described], for felling, bunching and skidding whole trees in one continuous cycle, was developed. The method of logging is for the machine to move from one skid road to the next, felling, bunching and skidding trees as it goes, the skid roads being at such a distance apart that the VFB has a full load by the time it reaches the next road. Data are given for production (cords/hr.) when logging in six different site types in the boreal forest (mainly Black Spruce, Balsam Fir, and White Birch). Some details of operational costs are given.

4473. Wilson, D. **The Garrett Tree Farmer.** *Woodl. Sect. Index Canad. Pulp Pap. Ass.* No. 1970 (*B*-8-*f*), 1960. pp. 7.

Description, specifications and performance data of this 38·5-h.p., 4-wheel-drive, pneumatic-tyred tractor for skidding tree-lengths.

4474. Wilson, D. **Skidding with the Garrett Tree Farmer.** *Timber of Canada* 21 (6), 1960 (43 . . . 49).

A report of tests with this tractor [see preceding abstract] in snow to a depth of 14 in. Specifications, and data on performance, production and costs are tabulated.

4475. Page, P. E., and Ross, A. **Mechanical operation on Q.N.S.P. Co. limits.** *Woodl. Sect. Index Canad. Pulp Pap. Ass.* 1948 (*B*-1), 1960. pp. 7.

Describes in fair detail a pulpwood logging operation with mechanized skidding by Muskeg tractors, including data on output and costs.

4476. Adams, W. J., Jr. **Traction and steering research of wheeled and tracked vehicles.** *Pulp Paper Mag. Can.* 61 (4), 1960 (176 . . . 185, 228).

With a view to the quantitative determination and comparison of the traction and steering characteristics of 4-wheel-drive vehicles (having several different steering and drive systems) and conventional 2-wheel-drive and tracked vehicles, a special research vehicle was developed that made possible the quick evaluation of 17 different drive and steering combinations. The results of low-speed drawbar tests showed that the geometrically steered 4-wheel-drive vehicles most closely approach the drawbar characteristics of tracked vehicles. The frame-steered vehicle was superior in its ability to traverse mud. High-speed tests on a macadam surface also showed the geometrically steered vehicles to be superior to the skid-steered ones. Of the skid-steer drive systems, the variable ratio type came closest to the pulling and steering characteristics of the geometrically steered vehicles. *From author's summary.*

4477. Rosenstock, H. Ein Einachsschlepper-System für den Forstbetrieb. **[A two-wheeled tractor for forestry.]** *Forstarchiv* 31 (5), 1960 (74–6). [G.]

Gives price and specifications for the Bungartz L5 Diesel 13-h.p. 2-wheeled tractor and its various attachments. Running costs and costs of specific operations (including labour) are shown.

4478. Kantola, M., and Puoskari, O. Tutkimuksia maatalouspyörätraktorin lumikelpoisuuden lisäämiseksi. **[Studies on increasing the suitability of wheeled tractors for use on snow.]** *Julkaisu, Työtehoseura, Helsinki* No. 86, 1960. pp. 67. 16 refs. [Fi.fi.e.]

Presents detailed results of experiments on the mobility of tractors in different depths and types of snow, on the use of auxiliary equipment (half-tracks, chains, extension wheels, skis, etc.) to increase mobility [cf. *F.A.* 18 No. 1705], and their effect on costs.

4479. Protopopov, N. P. Predpuskovoj obogrev parom dizel'nyh dvigatelej JaAZ-204 v zimnee vremja. **[Steam-heating the JaAZ-204 diesel engine before starting in winter.]** *Lesn. Ž., Arhangel'sk* 2 (1), 1959 (92–6). [Russ.russ.]

Describes an experimental device for warming up lorry engines, and tests made on it at air temperatures from −10° to −34° C.

4480. Epifanov, B. E. Rasčet verhnego stroenija puti lesovoznyh uzkokolejnyh železnyh dorog s pomošč'ju grafikov i linejki. **[Calculation of the structure of narrow-gauge railway lines for wood transport, with the aid of graphs and a ruler.]** *Lesn. Ž., Arhangel'sk* 2 (1), 1959 (75–83 + 2 sets of gphs.). [Russ.]

Present graphs and tables to assist planners and construction gangs in rapid determination of the most suitable track construction, type of line, and sleeper dimensions, with regard to the soil properties.

4481. Elliott, D. R. **The transportation of pulpwood chips in pipelines.** *Pulp Paper Mag. Can.* 61 (5), 1960 (170–2, 174–5).

From a study of the possibilities of hydraulic transport of pulpwood chips from forest to pulpmill, it was concluded that: (1) chip deterioration in transit is not serious enough to matter; (2) mixtures containing 30% of chips (calculated by volume as solid wood) can be handled; (3) friction losses and power requirements for mixtures are likely to be very close to those for water alone. An example of the application and operating costs of a pipeline is worked out, and the calculations of required pipeline capacity, feeder pipelines, branch pipelines, power requirements, investment and operating costs are given. In the example given, the total operating cost for transport only is worked out, assuming a forest of 30 × 50 miles, of which 900 sq. miles is productive; total volume 5 million rough cords; total period of cut 20 years; annual cut 250,000 cords; and a distance of ca. 75 miles from forest to pulpmill. [Cf. *F.A.* 20 p. 662, Canada.]

378. Water Transport

See also Nos. 4950, 5091, 5142.

4482. Jakovlev, L. S., and Gimel'berg, M. B. Splotočnaja mašina "Neva". **[The Neva bundle assembly unit.]** *Lesn. Prom.* 1960 (4), (17–20). [Russ.]

Describes and illustrates the design (giving the main specifications) of the Neva, a fully mechanized floating unit designed for bundling logs 4–7 m. long into bundles of 30–60 cu. m. and 2–3 m. draught.

4483. Koloskov, V. N. Zimnjaja splotka drevesiny v stanke-forme. **[Bundle assembly in forms in winter.]** *Lesn. Prom.* 1960 (3), (15–6). [Russ.]

Another variant of the technique [cf. *F.A.* 20 Nos. 611–2, 1901].

4484. Zotov, N. V. Novyj sposob sčalivanija šljuzuemyh plotov. **[A new method of connecting**

[units of large] rafts that have to pass through locks.] *Lesn. Prom.* 1960 (5), (22–3). [Russ.]

Describes and illustrates the new method made necessary by the increasing number of dams (with locks) being built on the Kama-Volga river system.

4485. Kuznecov, D. V. Mehanizacija podači lesa v vorota zapani. **[Mechanized feeding of timber into boom gates.]** *Lesn. Prom.* 1960 (4), (15–7). [Russ.]

The pontoon-mounted log-mover described consists basically of a set of endless belts, each fitted with serrated grabs. The belts, which have a combined total working width of 10·5 m., move at 0·73 m./sec. just above the surface of the water, so that the grabs engage with the floating logs, speeding them through into the raft-making depot. [Cf. *F.A.* 17 No. 1677; 20 No. 4692.]

4486. Zubankov, S. F. Mehanizacija formirovanija morskih plotov-sigar. **[Mechanized formation of sea-going cigar-shaped rafts.]** *Lesn. Prom.* 1960 (3), (16–9). [Russ.]

Reviews the mechanization (cranes, winches, etc.) introduced in the last few years in raft-building on the lower Amur river, whence rafts are towed to Kamchatka, Japan and Korea.

4487. Nylinder, P. Flytbarheten hos nedsvallat furuvirke. **[Buoyancy of Pine timber that has been frozen in.]** *Uppsats. Instn. Virkeslära K. Skogshögsk., Stockh.* No. *R*22, 1959. pp. 36 + 49 tbls., 6 photos. 13 refs. [Sw.sw.e.]

For the purposes of the study, one batch of logs (*a*) was kept under water from Nov.–Dec. 1954 until the end of Feb. 1955, and then stacked, after which water was pumped over it so that the whole stack was embedded in ice; a second batch (*b*) was stacked normally through the period. In April (*a*) or March (*b*), half the logs in each batch were covered with branches or straw (finally removed in May–June) to delay the melting of snow and ice and to create poorer drying conditions. From mid-June to October all logs were floated in a ring-boom. Logs were weighed at intervals throughout the experiment, and green density was determined after felling, after freezing, at launching, and during floating. Data in graphs and tables include variations in green density, drying, and water absorption, by diameter classes and heartwood %. A regression analysis shows that water absorption (kg./cu. m.) by unbarked logs during floating decreases with increasing diam., heartwood % and green density at launching. Heartwood % has less, and diameter more, effect in barked than in unbarked logs. General conclusions are that logs in group (*a*), if sufficiently dried, showed no greater water absorption than those in (*b*), and that as long as logs that have been frozen in are in positions where drying conditions are good, so that they can dry out before launching, no special treatment is necessary.

4488. Cayford, J. E. **Underwater logging.** *Sth. Lumberm.* 200 (2495), 1960 (41 . . . 45). 1 ref.

Describes the business of large-scale salvaging of sunken logs, as practised by the author's company in Bangor, Maine. Apart from an underwater crew with aqua-lungs and buoys, heavy hauling equipment is needed. Most sinkers are found near old booms (nearly 1½ million bd. ft. near one on the Penobscot river). Salvaged Pine and other softwoods are stated to be better than fresh logs, rarely showing, and never developing, blue stain. The colour of water-cured Pine is a soft pink, drying to a beautiful gold that fetches high prices. [Cf. *F.A.* 20, p. 489 U.S.A.]

4489. Karavaev, A. M. Gidravlika potoka pri razborke brevennogo pyža v zapani. **[[Changes in] flow hydraulics during the breaking-up of a log jam at a boom.]** *Lesn. Ž., Arhangel'sk* 2 (1), 1959 (84–91). [Russ.russ.]

A theoretical analysis, along with the results of experiments in a model tank, which confirmed that it is better to make a longitudinal corridor in the middle of the river than to break up the jam across the whole width of the river.

4490. Mettus, K. Ja., and Kalakuckij, I. K. Sortirovočnaja mašina "Paša". **[The Paša sorting unit.]** *Lesn. Prom.* 1960 (5), (20–2). [Russ.]

Description, with specifications and illustration, of the unit, which is used for log sorting in floating depots.

4491. Solov'ev, B. A., and Kukovickij, F. G. Novoe v tehnike lesosplava. **[New floating equipment.]** *Lesn. Prom.* 1960 (3), (11–4). 1 ref. [Russ.]

[Cf. *F.A.* 19 No. 4310.] Describes booms; circular saws to replace chain saws; drills fitted to power saws; special boats for dropping and weighing anchors; winches; arches for lifting vessels out of the water for repair; bundling machinery; mobile pile-drivers; and boats with submersible bulldozer attachments for deepening floating channels.

4492. Arykin, I. G., Voskresenskij, Ju.S., and Lebedev, M. P. Polnost'ju mehanizirovat' dnouglubitel'nye raboty. **[Fully mechanized deepening of floating channels.]** *Lesn. Prom.* 1960 (3), (9–10). [Russ.]

Describes the ZMC dredger.

4493. Bogatyrev, A. Ja. Razgruzka sudov lebedkami. **[Unloading barges by means of winches.]** *Lesn. Prom.* 1960 (3), (19–21). [Russ.]

Describes in detail the set-up for pulling stacks of logs off a barge and into the water, using winches on the bank.

4494. Hughes, J. R. **The outboard motor—the new ice-making machine.** *Woodl. Sect. Index Canad. Pulp Pap. Ass.* No. 1949 (*B*-10), 1960. pp. 5. 1 ref.

An account of trials on the use of an outboard motor fixed over a hole in the ice to throw water over the ice surface. Very good results were obtained, and the method is recommended.

4495. Gold, L. W. **Field study on the load bearing capacity of ice covers.** *Pulp Paper Mag. Can.* 61 (5), 1960 (153–4, 156–8). 5 refs.

Observations on the bearing capacity (b.c.) of ice (from reports on break-through and max. load) are compared with some of the formulae available (N. American and Russian) for predicting b.c. The number of observations made hitherto is insufficient to provide a basis for empirical rules relating b.c. to ice thickness, quality and other properties, or to show that formulae given in the literature for safe b.c. are valid.

4496. Žučin, V. N. Opylivanie uskorjaet tajanie l′da. [**Dusting accelerates ice melt.**] *Lesn. Prom.* 1960 (3), (10–1). [Russ.]

Trials were made in the U.S.S.R. in 1958 of covering lake ice with coal dust (applied from aircraft) to accelerate melting [cf. *F.A.* 13 No. 231] and thus increase the time available for floating. This measure, in conjunction with blasting, proved satisfactory, and can free lakes from ice 7–10 days earlier than normal. For best results, the layer of dust should be 5–7 mm. thick (i.e. 180–200 g./sq. m.), and should be applied in 3–4 operations within a period of 5–8 days.

38. Forest Engineering

381. Materials (including Explosives)

4497. Philipp, P. Sprengen mit Hilfe von plastischem Sprengstoff. [**Plastic explosives.**] *Wald u. Holz* 41 (8), 1960 (220–1). [G.]

Describes the use (e.g. in road-building) of explosive pastes, sold under such proprietary names as Axonit, Rhonit, Argonit, which are spread on the cleaned surface of boulders etc., requiring no bore-holes. The boulders are said to break into many small pieces under the impact of the explosion, with little danger of flying chips. Ca. 200–350 g. are required per cu. m. of stone.

4498. Fiołek, S. Zastosowanie środków strzałowych do łupania i karczowania pniaków oraz do karczowania i ogłowiania drzew. [**Use of explosives for splitting and rooting out stumps, and for rooting out and topping trees.**] *Las Polski* 34 (5; 6), 1960 (15–8; 17–9). [Pol.]

On the basis of trials in Poland in 1959, describes and illustrates the methods, possibilities and results of using explosives for: (1) splitting stumps; (2) uprooting fresh stumps; (3) uprooting trees; and (4) topping standing trees, or removing all the branches from standing trees. In (4), tests were successfully carried out on Scots Pine, Oak and Beech.

383. Roads and Bridges

See also No. 4379.

4499. Waldwegebau. [**Forest road-building.**] *Allg. Forstzeitschr.* 15 (29), 1960 (313–29). 14 refs. [G.]

A special number, including articles on the improvement of rides, developed at Attenbühl Instruction Forest, involving the creation of a rounded profile by roadmaking equipment, followed by disking, liming and the sowing of grasses and clover, so as to provide for better extraction, safer fire lanes (suppression of *Molinia*), and game pasture (*E. Volkert*); on gravel roads, their profile, surface, maintenance etc. (*G. Reissinger*); and on chemical weedkillers for roads, rides, verges, etc. (*G. Günther*).

4500. Sonderheft Waldwegebau. [**Special number: forest road-building.**] *Forst- u. Holzw.* 15 (6), 1960 (105–22). Many refs. [G.]

A collection of papers: The "Schotterfix" road-metal distributor (*W. Schweigler*) [a report of tests by the Waldwegebau working circle on this distributor, which is for use on tip-up lorries]; Experience with the Poclain excavator in ditch-cleaning—3 reports from different sources (*D. Fischer*; *H. Willing*; *H. Zanner*); Catchpits made of prefabricated concrete parts for use with pipe culverts (*Kiesekamp*); Soil stabilization with road tar in forest road-building (*H. Riemann*); The co-ordination of experience in forest road-building and road-building at the Forschungsgesellschaft für Strassenwesen (*E. W. Goerner*).

4501. Skripov, N. I., and Savin, L. E. Kolejnoe pokrytie iz železobetonnyh plit. [**Tracks made of reinforced concrete slabs.**] *Lesn. Prom.* 1960 (4), (3–4). [Russ.russ.]

By 1959 several roads in the Vologda and Archangel regions had been made with such slabs [see *F.A.* 19 Nos. 4317–8]. The costs and performance of some of these roads are discussed, and it is concluded that the slabs are highly suitable for making main and branch lorry roads in areas with limited natural supplies of gravel, and also have advantages over wood/earth coverings for spur roads.

4502. Kaliský, A., and Lehotský, L. Zriaďovanie zvážnic a priestorová úprava lesa. [**Forest road lay-out [in mountainous areas], and forest management.**] *Lesn. Čas.* 6 (2), 1960 (114–29). [Slovak.russ.g.]

Discusses: a method of planning the general layout of an earth road system, illustrated by three examples; the question of costs; and the actual work involved in building the roads.

4503. Lehto, R. Havaintoja lumessa kulkevien ajoneuvojen ja polanneteiden rakennustekniikan kehityksen nykyvaiheesta Ruotsissa. [**Observations on the present phase of development of snow vehicles and techniques of building packed-snow roads in Sweden.**] *Tied., Metsäteho, Helsinki* No. 165, 1959. pp. 6. [Fi.e.*e.*]

In a demonstration in N. Sweden, forest tractors with cardan-driven snow-packing equipment and auxiliary steering mechanism with hydraulic drive were shown. The Snövispen, a tractor-driven device, consisting of a rotating axle carrying chains to mix and compact the snow, proved the best snow-packer. A vibrating plate for snow-packing has given good results in Finland. Equipment shown is illustrated by photographs, with English legends. [Cf. *F.A.* 21 No. 3249.]

4504. LE RAY, J. L'entretien courant des routes en terre et la lutte contre la tôle ondulée. **[The maintenance of earth roads and control of corrugations.]** *Bois For. Trop.* No. 70, 1960 (49–56). 3 refs. [F.e.span.]

Describes the method of making and using 'home-made' drags for use with a tractor for road maintenance. Stress is laid on the importance of maintaining the degree of camber that best stands up to rain and traffic.

385. Drainage, Irrigation, Sedimentation. Water Supply

See Nos. 4378–9, 4434.

386. Waterways. Stream Training

See Nos. 4491–2.

4. FOREST INJURIES AND PROTECTION

41. General Technique of Forest Protection. Types of Injury

See also Nos. 4315–6, 4466.

4505. GUSTAFSSON, M. Bekämpningsmedelsrester i gröda och jord: en litteraturöversikt. **[Residues of pesticides in crops and soil: a review of literature.]** *K. Skogs- o. LantbrAkad. Tidskr., Stockh.: Suppl.* No. 4, 1960. pp. 107. 19 pp. of refs. [Sw.e.]

Discusses methods of analysis, effects of insecticides, fungicides and weedkillers on plants, humans and animals, the effects of accumulations in the soil on plants and soil fauna, and ecological effects, with particular reference to Swedish conditions. Some of the literature cited relates to forestry.

4506. **Plant quarantine announcements—Sweden.** *FAO Plant Prot. Bull.* 8 (3), 1959 (33–6).

Lists rules governing the importation of plants (including trees) into Sweden.

4507. **A photo technique for recording surface defects on standing trees.** *Extr.* from *Rep. Cent. St For. Exp. Sta. 1959*, 1960 (64–5).

Stereo pairs of photographs are being used in Kentucky to make permanent records of surface defects on standing White Oak trees. These will be useful in studies where it is desired to follow the changes in surface defects as trees grow, or as a result of management techniques. Stereo pairs are taken of the lower 32 ft. of the stem, using a 4 × 5 view camera with a wide-angle lens. The camera is mounted on a slotted bar to facilitate rapid moving of the camera before taking the second photo of the pair.

42. Injuries from Inorganic Agencies other than Fire

4508. OHNESORGE, B. Deutsche Forstschutz-Literatur 1958. II. Abiotische Schäden. **[German forest protection literature, 1958. II. Abiotic damage.]** *Z. PflKrankh.* 67 (5), 1960 (279–83). 27 refs. [G.g.] E.M.B.

Surveys and lists articles from German forestry periodicals on damage caused by fires, frost, heat, hail, windstorms and smoke.

421. Air Currents

See also No. 5094.

4509. WADSWORTH, F. H., and ENGLERTH, G. H. **Effects of the 1956 hurricane on forests in Puerto Rico.** *Carib. For.* 20 (1/2), 1959 (38–51). [E.]

Presents the results of observations made both from the air and from the ground. The most general type of damage was defoliation; loosening and shredding of the bark, breakage, and uprooting also occurred. The relationship was studied between damage and site and type and condition of the forest; a list is given of trees according to their susceptibility to different kinds of hurricane damage. Injury was as serious on sites protected from normal winds as on those exposed. Forests on slopes are susceptible regardless of aspect. Uprooting is common on wet soils. Uneven-aged, mixed forest frequently suffers slight and selective damage, while even-aged pure forest generally suffers either very seriously or not at all. Heavy thinning increases liability to injury.

422. Temperature Influences. Frost. Heat. Drought

See also Nos. 4136, 4684, 4720, 4770, 4779.

4510. AKIMOČKIN, N. G. Zimostojkost′ hvojnyh i listvennyh porod na Lesostepnoj opytno-selekcionnoj stancii (Lipeckaja oblast′). **[The winter-hardiness of coniferous and broadleaved species at the Forest Tree Breeding Station for the Forest-steppe Zone (Lipetsk region).]** *Bot. Ž.* 45 (1), 1960 (123–31). [Russ.russ.]

Discusses weather of the winter 1955–56, one of the severest since the inception of the Station in 1924, with temperatures reaching −45·5° C. A table of introduced tree species (30 conifers, 51 broadleaved) shows for each the age, mean diameter and height, aspect and gradient, and a 5-point hardiness rating (from I—unharmed, to V—completely killed).

4511. MORGENEYER, W. Beobachtungen über Frostschäden und *Cytospora*-Befall im Pappelsortenregister in Graupa nach der anomalen Witterung der Winter 1954/55 und 1955/56. **[Frost damage and *Cytospora* infection in the Poplar varieties collection at Graupa after the abnormal winters 1954–54 and 1955–56.]** *Wiss. Abh. Dtsch. Akad. LandwWiss., Berl.* No. 44 (*Beitr. Pappelforsch.* No. 4), 1960 (23–49). 13 refs. [G.g.russ.e.]

Frost cracks were the chief form of damage in 1954–55, and fungus attack (chiefly *C. chrysosperma* but also *C. nivea* and in some cases wood-destroying fungi) in the year following. The section *Aigeiros* suffered more than *Tacamahaca*. Among the widely used cultivars, *Populus* × *robusta* and *P.* × *regenerata* suffered most, *P.* × *marilandica* and *P.* × *serotina* least. *Populus trichocarpa* remained almost unaffected. The influence of species and variety was greater than that of local site differences, though Graupa as a whole was hit harder than other E. German plantations. In 1955–56, 53% of 3-year-old plants were damaged (20% fatally) and 44% of the 6- to 7-year-old (4% fatally). The 1-year-old plants suffered hardly at all. Frost and fungus damage were generally, but by no means invariably, on the same plants. *From author's summary*.

4512. MORGENEYER, W. Über Spätfrostschäden im Pappelsortenregister Graupa im Frühjahr 1959. **[Damage by late frost in the spring of 1959 in the Poplar varieties collection at Graupa.]** *Wiss. Abh. Dtsch. Akad. LandwWiss., Berl.* No. 47 (*Beitr. Pappelforsch.* No. 5), 1960 (43–56). 9 refs. [G.g. russ.e.]

A frost on the night of 20–21 April injured some species and varieties of the section *Aigeiros* slightly and some of the section *Tacamahaca* considerably; crosses between the two sections, particularly *Populus* × *generosa* suffered severely. Little or no damage was suffered by *P.* × *robusta*, *P. trichocarpa*, *P. petrowskyana*, *P. przewalskii* and the Jablokov hybrids (*P. suaveolens* × *P. berolinensis* and *P. suaveolens* × *P. tremula*). Damage included blackening and yellowing of leaves, and complete or partial killing of roots; it was clearly connected with the stage of leaf development and appeared also to have some connexion with the specific morphological and physiological characters of leaves.

4513. REISCH, K. W. **Effect of drought on plant growth**. *Proc. 34th Nat. Shade Tree Conf. 1958*, 1959 (11–23). 16 refs.

Reviews the internal and external effects of drought on trees, and factors affecting drought resistance.

4514. MUDRICH, H. Die Auswirkungen der Trockenheit des Sommers 1959 auf die Niederwaldumwandlungskulturen im Siegerland. **[The effects of the 1959 summer drought on the coppice conversion plantations in the Siegen area.]** *Forst- u. Holzw.* 15 (8), 1960 (152–6). [G.g.]

Precipitation in 1959 was 36% below, and temperatures were several degrees above, the long-term average. Species planted in April and May were quite satisfactory in June, though Japanese Larch and Beech already showed mortality up to 30%. By autumn, mortality on sunny slopes was 50–80% for Spruce and 80–100% for Japanese Larch, and on shady slopes 10–25% and 50% respectively; for Beech, under shelter, it was ca. 50%. Conclusions are drawn on the correct choice of species for various sites, the advantages of shelter (Birch) on sunny slopes, the best planting methods, etc.

423. Precipitations

4515. CRAMER, H. H. Hubschrauber gegen Schneebruchschäden? **[Helicopters to prevent snow breakage?]** *Allg. Forstzeitschr.* 15 (20), 1960 (293 . . . 296). 1 ref. [G.]

Describes test flights in the Freiburg region to ascertain whether the air movement caused by helicopter rotors could be used to shift dangerous layers of wet snow off tree crowns. In these flights, made with a Bell 47G over Spruce and Silver Fir loaded with 5–7 cm. of wet snow, the snow was shaken off the top 2–3 m. of the crowns of mature trees for a width of 10–14 m. In younger stands, whose more flexible stems swayed more, the effect was greater. Some 30–40 ha./hr. could be treated at a cost of ca. DM. 19/ha. The difficulties (notably the need for flying weather, considerable pilot skill, since flights must be made $\not>$ 6–7 m. above tree-top level, and organization of operations at short notice) are admitted to be great. The danger of the rotors' causing breakage under certain conditions is not overlooked, but none occurred during these tests.

424. Soil Conditions; Erosion Effects

4516. Schadelijke invloed van NaCl op diverse houtsoorten. **[The harmful effect of NaCl on different tree species.]** Centrum voor Landbouwpublikaties en Landbouwdocumentatie, Wageningen. 1959. pp. 1. [Du.]

A bibliography of 7 references dealing mainly with the effect of the sea floodings in the Netherlands in 1953.

4517. HOLMES, F. W. **Salt injury to trees.** *Abstr.* in *Phytopathology* 50 (4), 1960 (240).

NaCl and $CaCl_2$ were applied to Maples, Oaks, Black Birch and White Pine trees. A Sugar Maple died after 186 weekly applications of 10 lb. NaCl to the soil within a 12-ft. radius. Chloride concentration in its leaves was 76 times and in its twigs 12 times that in controls. Other Maples, the Birch and the Pine died after 201 applications of NaCl over their roots, but a White Oak so treated showed no symptoms. After similar treatment with $CaCl_2$, a Red Maple bore stunted yellow foliage, while a Black Oak appeared normal. The leaves of Sugar Maples adjacent to a road surface that had been salted 15 times at weekly intervals in 4 winters with NaCl or $CaCl_2$ increased their chloride content 3–6 times, but twigs showed no increase and the trees no symptoms of injury. Evidently the salt is accumulated in the leaves and sloughed off with them each autumn.

4518. CHILD, R., and SMITH, A. N. **Manganese toxicity in *Grevillea robusta*.** *Nature, Lond.* 186 (4730), 1960 (1067). 1 ref.

G. robusta is commonly grown as a shade tree in E. African Tea plantations. Seedlings are usually raised in nurseries and transplanted to the field when ca. 4 in. high. Failure of the plants has been reported when they are transplanted into the red, highly acid soils characteristic of some Tea areas, of which the pH may be as low as 4·2. Examination of two specimens that had died 3 weeks after planting out on such a site, showed that they contained 1940 and > 4000 p.p.m. of Mn respectively, vs. 800 p.p.m. for a healthy seedling. Similar results were obtained from another estate. Local applications of basic slag are recommended when transplanting into acid soil. It is noted that, in Ceylon, basket-plants of *G. robusta* and *Albizzia moluccana* are potted in a soil limed to a pH value of between 6·0 and 7·0.

4519. Smith, A. N. **Boron deficiency in *Grevillea robusta*.** *Nature, Lond.* 186 (4729), 1960 (987). 2 refs.

Die-back of *G. robusta* shade trees in a Tea plantation in Kenya was probably due to B deficiency in the soil. Analysis of a sample of foliage showed one healthy leaf to have the highest B content (17 p.p.m.) and one from a diseased tree the lowest (13 p.p.m.). Analysis of soil samples from the affected area and a healthy area also showed an appreciably lower content of water-soluble B in the former at all levels from 0 to 36 in.

4520. Purnell, H. M. **Nutritional studies of *Pinus radiata* Don. 1. Symptoms due to deficiency of some major elements.** *Aust. For.* 22 (2), 1958 (82–7 + 4 photos). 17 refs.

The visible symptoms caused by deficiency of Ca, Mg, K, and N in *P. radiata* seedlings grown in sand are described. In the treatment in which P was omitted from the nutrient solution, the plants grew very slowly at first but rapidly later. Since the sand in which they were growing contained some apatite, it is believed that the mycorrhizal fungus was able to mobilize P from the apatite and make it available to the Pines.

4521. Hacskaylo, J., and Struthers, P. **Correction of lime-induced chlorosis in Pin Oak.** *Res. Circ. Ohio Agric. Exp. Sta.* No. 71, 1959. pp. 5 + 2 photos, 1 gph. 4 refs.

Fe deficiency was identified as the cause of chlorosis in *Quercus palustris* growing near Wooster, Ohio, by a favourable response to foliar application of the element. Soil tests indicated that the condition was probably lime-induced. Although the chlorosis was corrected by adding chelated Fe to the soil, it was found that a reduction of the soil pH was sufficient to adjust the availability of Fe to the tree. The criterion used in applying treatments was titration of soil from the root zone rather than tree diameter. Addition of S to the soil did not check the progressive severity of the chlorotic condition during the growing season; evidently its oxidation was too slow to lower the pH with the required speed once visual symptoms appeared. H_2SO_4, however, proved effective and rapid in correcting the chlorosis, though requiring careful handling. [Cf. *F.A.* 17 No. 4058, and J. C. Brown in *F.A.* 18 No. 83.]

425. Chemical Influences (Atmospheric)

See also No. 4939.

4522. Sonderheft Rauchschaden. **[Special number: Smoke damage.]** *Forst- u. Holzw.* 15 (3), 1960 (245–64). Many refs. [G.]

Contains, besides Härtel's paper and the first of Rohmeder's papers [see *F.A.* 21 No. 3269], the following; A new law on smoke emission in W. Germany (*K. F. Wentzel*); Prevention of smoke damage in the forest by forestry measures [i.e. by conversion] (*F. Lampadius*); and Forestry measures to assess and prevent smoke damage to forests in the Czech part of the Erzgebirge (*J. Materna*).

43. Forest Fires

See also Nos. 4130, 4185, 4508, 5189–90.

431. Predisposing Factors and Causes. Fire Danger. Fire Behaviour

4523. Coffin, H. **Effect of marine air on the fireclimate in the mountains of southern California.** *Tech. Pap. Pacif. Sthwest. For. Range Exp. Sta.* No. 39, 1959. pp. 30.

It was found from detailed and widely based observations that the marine influence in seaward parts of S. California is widespread and extends to high altitudes. There is a distinct seasonal variation in the frequency and intensity of the penetration of marine air. The seasonal minimum of its influence coincides with the seasonal temperature maximum, suggesting that the two are related. There is a smaller incidence of major forest fires, during the critical months, on days when the influence of the relatively cool, moist marine air is strong and the moisture content of fire fuels is higher.

4524. Amiot, L.-P. Inflammabilité et pouvoir thermique de la matière organique de certains types forestiers. **[Inflammability and thermal properties of the organic matter of some forest types.]** *Contr. Fonds Rech. For. Univ. Laval* No. 3, 1959. pp. 24. 7 refs. [F.f.e.]

A study was made to determine whether forest types could be used as an index of the capacity of forest litter to ignite and start a fire. The factors measured were (*a*) heat of combustion, (*b*) hygroscopicity, and (*c*) "kindling" temperature [temperature of briquette at moment of visible combustion]. Samples of litter were collected from 12 forest types, and these were dried, crushed, sieved to a 2-mm. diameter, briquetted, and then tested for the factors under investigation. The results indicated that (*a*) differed considerably between samples. The more conifers (particularly Balsam Fir) the stand contained, the higher was the (*a*) of its litter. The value of (*c*) was found to be practically the same (between 230° and 235° C.) for all samples, and so was the minimum oven temperature (190–192°) at which litter had to be held for self-heating to render combustion possible. Values of (*b*) varied very little.

4525. **More fuel in bottomland forests.** *Extr. from Rep. Sth. For. Exp. Sta. 1959*, 1960 (31–2).

Samples taken from 23 locations averaging 86 sq. ft. b. a./acre in the Delta Experimental Forest (mixed hardwoods) before the main autumn leaf-fall indicated total ground fuel to be ca. 21,000 lb./acre (including leaves 4290, sound wood 1543, and duff 12,963 lb.), i.e. in the range of the high-hazard Southern Pine woods.

4526. Mactavish, J. S. **A new worry in forest fire control.** *Timber of Canada* 21 (6), 1960 (61, 56).

Discarded aerosol cans are thought to have started several fires in Canada by focusing reflected sunlight. Experiments have since proved that this is quite possible, given a suitable combination of conditions. Painting the bottoms of the cans could eliminate this problem.

4527. FENNER, R. L., and BENTLEY, J. R. **A simple pyrometer for measuring soil temperatures during wildland fires.** *Misc. Pap. Pacif. Sthwest. For. Range Exp. Sta.* No. 45, 1960. pp. 9. 8 refs.

Reviews types of soil temperature recorders, and gives a detailed account of the construction and use of a fusion pyrometer already briefly described [cf. *F.A.* 20 No. 1952] and the tool devised for planting it in the soil.

4528. ZIEGER, E., and LANGE, S. Beiträge zur Waldbrand-Prognose. **[Forecasting of fire danger [in E. Germany].]** *Arch. Forstw.* 9 (2), 1960 (97–108). 4 refs. [G.g.russ.e.]

Analysis of answers to a questionnaire on causes, weather conditions, local danger areas etc. of fires in 1957. Railways caused 30·9%, military exercises 9·9, tractors 4·4, lightning 0·9, the rest being grouped mainly under negligence and unknown causes. Nearly half the fires started when air humidity (measured any time between 7 a.m. and 1 p.m.) was $> 60\%$, and the r.h. % of existing official danger ratings will have to be raised. Over 60% of fires occurred after <1 mm. of rain had fallen during the previous 10 days, and nearly 50% at temperatures $> 20°$ C.

4529. CRAMER, O. P. **Relation of number and size of fires to fire-season weather indexes in western Washington and western Oregon.** *Res. Note Pacif. Nthwest. For. Range Exp. Sta.* No. 175, 1959. pp. 11. 2 refs.

Presents equations based on data for the period 1944–56, expressing the expected occurrence of man-caused fires for given fire-season (April–October) weather, in terms of 3 indexes: total number of rainless days; average number of days since a wetting rain; burning index, a rating of the combined effect of fuel moisture and wind speed on rate of fire spread. With one exception, these equations were found to be significant at the 1% level. A re-computation of the occurrence equations, including year as an independent variable, showed a very significant annual increase in the number of fires in western Washington over the period. [Cf. *F.A.* 19 No. 1878.]

4530. CRAMER, O. P. **Forest fire weather and computed fire occurrence in western Oregon and western Washington in 1959.** *Res. Note Pacif. Nthwest. For. Range Exp. Sta.* No. 176, 1959. pp. 11. 1 ref.

Includes a comparison of (*a*) actual fire occurrence with (*b*) fire occurrence computed from the indexes mentioned in the preceding abstract. For various categories of fire, (*a*) is shown as a % of (*b*) for 1958 and 1959, with a 10-year average for the period 1949–58.

432. Prevention and Control

See also Nos. 4499, 4537.

4531. BENNETT, W. D. **The reduction of the forest fire hazard created by logging slash. A literature review.** *Woodl. Res. Index Pulp Paper Res. Inst. Can.* No. 117, 1960. pp. 56. 169 refs.

The literature is almost entirely N. American.

4532. CATTO, A. T. **Visibility maps for fire protection.** *Pulp Paper Mag. Can.* 61 (Convention No.), 1960 (252 . . . 268, 289).

Describes the procedure followed in evaluating and improving a fire-tower system, especially the drawing of individual visibility maps for each tower. It appeared that in flat country, with some steeply rolling sections, a tower spacing of 20 miles was satisfactory; field sketching of visibility could be done with reasonable accuracy, sufficient to indicate where new towers are needed, but further research on fluctuation in visibility from towers is necessary for final evaluation of the efficiency of a tower system; aerial patrol should be used in conjunction with, but should not replace, a tower system; a tower system is much less efficient than is generally realized, owing to visibility fluctuations.

4533. **Standard smokechaser pack frame and bag.** *Tech. Equipm. Rep. U.S. For. Serv.* No. 5100–10, 1960. pp. 18.

The new fire-fighting pack, designed at the U.S. Forest Service's Missoula Equipment Development Centre, Montana, incorporates the following basic features: (*a*) a moulded polyester fibreglass frame, brightly coloured for increased visibility, with a ventilating space and bottom support shelf; (*b*) a highly adjustable pack harness; (*c*) a high-capacity rucksack (2100 cu. in.); and (*d*) a tool-fastening arrangement that allows tools to be secured independently of the rucksack. The outfit, with minor modifications according to regional requirements, is to replace that based on the standard Clack pack frame which has been in use for the past 40 years.

435. Benefits of Fire Control. Injurious Effects of Fire

See also No. 4721.

4534. ALLEN, P. H. **Scorch and mortality after a summer burn in Loblolly Pine.** *Res. Note Stheast. For. Exp. Sta.* No. 144, 1960. pp. 2.

When an accidental "hot-spot" in a prescribed burn severely scorched 65% of the Loblolly trees, mortality after 1 year was 21%. It was greatest in the small diameter classes, and in trees with d.b.h. $\geqslant 8$ in. did not exceed 8%. Hardwoods were more susceptible to injury than Pine, *Ilex opaca* and Oaks suffering most and *Nyssa sylvatica* least.

4535. MANN, W. F., JR., and GUNTER, E. R. **Predicting the fate of fire-damaged Pines.** *Forests & People, Alexandria, La.* 10 (1), 1960 (26–7, 43).

Of 624 trees studied for 1–2 years in burnt-over stands from 16 years of age upwards in Louisiana, only 68 died. The pattern of mortality was the same for fall and spring fires, and Loblolly, Shortleaf, and Slash Pine reacted similarly. Contrary to expectations, barkbeetles had little or no influence on the fate of damaged trees. Needle scorch appeared to be more closely related than cambium injury to death of trees, but mortality was not heavy unless $> 90\%$ of the crown was damaged.

436. Beneficial Effects of Fire. Uses of Fire in Silviculture and Other Forms of Husbandry

See also Nos. 3949, 4235, 4238–40.

4536. Burcham, L. T. **Planned burning as a management practice for California wild lands.** Division of Forestry, Department of Natural Resources, California. 1959. pp. 21. 43 refs.

Shows that there is little historical or ecological evidence to support the designation of Californian plant communities as "fire-type" vegetation. While prescribed burns may be valuable means of land improvement, e.g. to prevent brush encroachment on grazing lands, the need for caution in their use is stressed; further research on the behaviour of fire and on its effects on soil and vegetation is required.

4537. Romancier, R. M. **Reduction of fuel accumulations with fire.** *Res. Note Stheast. For. Exp. Sta.* No. 143, 1960. pp. 2. 1 ref.

Presents some data on a 4-year burning programme for the purpose of fuel reduction, seedbed preparation, and understorey control in a 60-year Loblolly stand with a thick litter layer (average 4·8 in.) above a moist A_o horizon over poorly drained sandy loam. One winter and one summer fire reduced the total weight of fuel (32·8 tons of [leaf?] litter and 3·3 of woody components) by 9·1 tons; subsequent summer fires by a further 3·5 and 1·4 tons respectively. The A_o horizon formed part of the fuel under certain circumstances, e.g. when a stump or log caught fire and dried it out.

44. Damage by Harmful Plants. Virus Diseases

441. Weeds

See also Nos. 3951, 4322, 4395–6, 4499, 4505, 4622, 5164, 5208.

4538. Williams, J. R. **The control of Black Sage (*Cordia macrostachya*) in Mauritius: the introduction, biology and bionomics of a species of *Eurytoma* (Hymenoptera, Chalcidoidea).** *Bull. ent. Res.* 51 (1), 1960 (123–33 + 2 photos). 3 refs.

An account is given of the biology of *Eurytoma* sp. aff. *havardi*, and its bionomics in Mauritius where, since its introduction in 1950, it has supplemented the action of *Schematiza cordiae* in controlling *C. macrostachya* [cf. *F.A.* 16 No. 1872]. There is an appendix on the present ecological status of *C. macrostachya* in Mauritius [*P. O. Wiehe*].

4539. Dončev, Ž. V. Sravnitelni danni za vlijanieto na troskota (*Cynodon dactylon* L.) vărhu dărvesnite i hrastovite vidove v polezaštitnite pojasi i kulturite v Dobrudža. **[Comparative data on the effect of *C. dactylon* on [young] tree and shrub species in shelterbelts and plantations in the Dobruja region.]** *Nauč. Trud. Lesoteh. Inst., Sofija* No. 7, 1959 (339–65). 9 refs. [Bulg.f.]

Investigations showed all the species to be very susceptible to damage by *C. dactylon* in the first year or two after planting. Hopes that the grass could be eradicated by agricultural techniques after afforestation have proved to be illusory, and it should be eliminated before planting. The increment of almost all shrub species is checked by the grass; among trees, *Robinia pseudoacacia* is most susceptible to increment reduction, followed by *Fraxinus pennsylvanica* and *Gleditsia triacanthos*. *F. ornus* was not very susceptible, and *F. oxycarpa*, *Quercus borealis* var. *maxima*, *Q. cerris* and especially *Q. robur* were relatively unaffected. *Prunus mahaleb* and *Celtis australis* were among the more resistant species, and *Morus alba* and *Tilia tomentosa* among the more susceptible.

4540. Hansen, H. L., *et al.* **Quack grass control by herbicides in Red Pine plantations.** *Minn. For. Note* No. 87, 1960. pp. 2.

Amitrol, dalapon, diuron and simazine were tested over two successive years for control of quack grass (*Agropyron repens*) and possible harmful effects on trees in young *Pinus resinosa* plantations. Rates of application were (*a*) 2½, (*b*) 5, (*c*) 10 lb./acre of active principle in 100 gal. water. Seedlings were shielded during spraying. A 1958 application of simazine at (*b*) gave residual control in 1959, and, at (*a*), it was the most effective 1959 treatment. Amitrol proved the most effective treatment in 1958, but, like dalapon, gave only temporary control in 1959 and damaged trees where spray drifted on to needles. At (*b*) or (*c*), diuron gave good control in both years, though it caused greatest mortality to seedlings. Simazine and diuron at (*b*) were effective against other grasses and weeds.

4541. Bagley, W. T., and Miyoshi, R. T. **Chemical weed control in windbarriers.** *Tree Plant. Notes* No. 40, 1960 (13–5).

Experiments in shelterbelt plantings up to 2 years old in Nebraska, with diuron and simazine (each at 4 lb./acre) and atrazine (2 lb./acre) indicated that one treatment at the beginning of the growing season gave good weed control without very serious damage to tree seedlings, and much increased survival. The most severe damage to seedlings was caused by diuron, but losses so caused were less than those caused by cultivation of weed-grown plantations.

4542. Yamaguchi, S., and Crafts, A. S. **Comparative studies with labeled herbicides on woody plants.** *Hilgardia, Berkeley* 29 (4), 1959 (171–204). 13 refs.

Relative mobility of 2,4-D, 2,4,5-T, ATA [amino triazole], MH [maleic hydrazide], urea, and monuron, was tested over a period of a year in the stems of (*a*) *Arctostaphylos manzanita*, (*b*) *Photinia arbutifolia*, and (*c*) *Aesculus californica*. From spot applications to the active phloem of the tree stems there was consistent absorption of 2,4-D and 2,4,5-T by the phloem; the peak of downward movement came at the time of full development of the season's flush of growth in all three species. The other compounds were more generally translocated by the transpiration stream. The phenoxyacetic acids were equally strongly absorbed both by the inner bark tissue and by the outer wood tissue of all three species, regardless of whether they were translocated by the phloem or by the xylem. ATA was very strongly absorbed by the xylem and lightly by the inner bark tissue of all species, regardless of whether it was transported by phloem or xylem.

The translocation characteristics and mobility of the compounds were relatively consistent from species to species. However, (*a*) was better translocated in the phloem than (*c*); monuron was most mobile in (*a*); MH and urea most mobile in (*b*) stems; and ATA in tip branches and in seedling plants of (*b*). Translocation of herbicides in the phloem can occur independently of the xylem. Downward movement in the stem was in the phloem and upward movement in the xylem. [Cf. *F.A.* 19 No. 562.] *From authors' summary.*

4543. **[Foliar absorption of herbicidal sprays.]** *Extr.* from *For. Res. Rep. Weyerhaeuser Co., Centralia, Wash. 1958*, 1959 (6).

In experiments with excised Alder leaves and radioactive 2,4,5-T and KH_2PO_4, the absorption ratio (concentration in the leaf in relation to that in the suspending solution) was highest at pH 3·0. At pH 8·0 it was poor. The toxicity of an oil solution had little effect on absorption during the 5 hours of the test. Absorption of both substances was better from an oil/water emulsion plus emulsifier than from water plus emulsifier alone.

4544. Bormann, F. H., and Graham, B. F., Jr. **Translocation of silvicides through root grafts.** *J. For.* 58 (5), 1960 (402–3). 3 refs.

A 30-year *Pinus strobus* plantation at a spacing of 6 × 6 ft. in the Mannabesic Experimental Forest, Maine, was chemically thinned with NH_4 sulphamate in 1956, and examined in 1958. Of the untreated trees (80 out of 151) on sample plots, 43% were dead. Excavations of root systems indicated that death had been caused by poison translocated through natural root-grafts. [Cf. *F.A.* 18 No. 4109; 21 No. 1559.]

4545. Dumbroff, E. B. **Aerial foliage sprays fail to eradicate scrub Oaks on Florida sandhills.** *J. For.* 58 (5), 1960 (397–8). 1 ref.

Outlines the results of tests of 12 chemical growth regulators in various formulations, to eradicate brush and grass on N.W. Florida sandhills to allow establishment of Pine. A total of 35 treatments were applied in June by helicopter, and their effectiveness in killing major weed species was assessed after two growing seasons. Best over-all control (34% kill) and best control of *Quercus laevis* (57%) and *Serenoa repens* (42%) were gained with the propylene glycol butyl ether ester of 2-(2,4,5-TP) at 3 lb. acid equivalent (a.e.)/acre in a non-phytotoxic oil/water carrier. The same dosage, but in a diluent of diesel oil and water, killed most *Q. stellata* var. *margaretta* (60%). *Q. incana* was best controlled by the iso-octyl ester of 2,4,5-T in water at 3 lb. a.e./acre (31%). No treatment controlled scrub to the extent required for successful Pine establishment and growth, and grasses, also serious competitors for available moisture, were little affected. Thus growth regulators cannot yet be recommended for sandhill site preparation. [Cf. *F.A.* 20 No. 4755.]

4546. Peevy, F. A. **Soil application of chemicals for control of Southern upland hardwoods.** *Forests & People, Alexandria, La.* 10 (1), 1960 (24–5, 37). 2 refs.

Both fenuron and monuron killed Oaks growing on upland sites, when applied in late winter or spring as soil injection treatments or when broadcast on the ground surface. These herbicides were effective at rates of ½ to 1 g. of active principle per inch of stem diameter. Fenuron was more effective than monuron for controlling Oaks, and its residue seemed less damaging to Pine after two growing seasons. Pines were injured if their roots were present in the area of application. These herbicides were effective when applied as a finely ground powder or as pellets. The cost of chemical and labour is ca. ½ cent for applying 2 g. of fenuron or monuron for each 4 in. of stem diameter as a soil surface treatment round the bases of trees. 2,4,5-T was more effective when applied to the lower 16 in. of the stem than when injected into the soil. *From author's summary.*

4547. Ivens, G. W. **The effects of arboricides on East African trees and shrubs—IV. *Tarchonanthus camphoratus* L. and *Euclea divinorum* Hiern.** *Trop. Agriculture, Trin.* 37 (2), 1960 (143–52). 4 refs.

[Cf. *F.A.* 21 No. 616.] A series of experiments is described in which 2,4,5-T and 2,4-D esters were tested on (1) *T. camphoratus* and (2) *E. divinorum*, woody weeds of grazing land in parts of the Kenya Highlands. With (1), trees not previously felled were killed by basal application of 2,4,5-T in diesel oil after preliminary frilling, and although some shoots grew, a second spray of lower concentration prevented any further growth. Trees regenerating after felling were much more difficult to kill, and though the growth regulators killed existing shoots, regrowth took place even after the clumps had been treated three times. Na arsenite paste was no more effective, but monuron, though slow acting, appeared to have possibilities as a soil treatment at rates of ca. 18 g./tree. With (2), mature trees were only slowly affected by 2,4,5-T or 2,4-D, and regrowth was not prevented. Treatment of regrowth from stumps, of shoots appearing from the ends of roots exposed by stump removal, and of root suckers at some distance from the main stump, appeared to give a good kill in some trials, but only temporary effects in others. There were no obvious differences between the two chemicals, and monuron was less promising than on (1). The season of treatment was not closely correlated with the degree of kill in these trials. It is thought that further work on the influence of time of year on the effectiveness of spraying might be useful with (2), but is unlikely to assist greatly in the control of (1). *From author's summary.*

4548. Kramer, M. Exterminação ou contrôle de plantas lenhosas e arbóreas nas pastagens de São Paulo. **[Extermination or control of woody and arborescent plants in pastures of São Paulo.]** *Arquivos do Instituto Biológico, São Paulo* 24, 1957 (257–68 + 2 plates). 18 refs. [Port.port.e.] C.G.B.

Esteron Brushkiller (4% by volume in diesel oil) was applied to *Myrcia* sp., *Campomanesia alba*, *Platypodium elegans* and *Stryphnodendron adstringens*. Basal stem treatments to a height of 50 cm. from the ground, or applications to the cut stump as well as the root collar and root system exposed to a depth of 20 cm., were more effective than applications solely to the stump cut to a height of 20 cm. from the ground. Formulations of 2,4-D (amine), Weedone LV-4 (butoxyethanol ester of 2,4-D) and Weedone 2,4,5-T (butoxy ethanol ester), 1% by volume in water, were sprayed on *Mimosa pudica*, *Sida rhombifolia* and other woody weeds. The most effective was Weedone. No damage was caused to useful grasses.

442. Parasitic (Higher) Plants. Epiphytes. Climbers

See also No. 4559.

4549. HAWKSWORTH, F. G. **Growth rate of dwarf-mistletoe infections in relation to the crown class of the host**. *Res. Note Rocky Mt. For. Range Exp. Sta.* No. 41, 1960. pp. 4. 3 refs.

Growth rates were determined for 234 main-stem dwarf-mistletoe infections from the rate at which new shoots formed at the upper and lower margins of the infection. The results supported the hypothesis that dwarf-mistletoes develop most rapidly in vigorously growing hosts. For both *Arceuthobium americanum* on *Pinus contorta* and *A. vaginatum* f. *cryptopodum* on *P. ponderosa*, the growth rate of infections in the stems of dominant trees was nearly twice that in suppressed trees. Rate of spread was ca. ⅓ greater down the stem than up. Contrary to previous reports [cf. *F.A.* 17 No. 2945], *A. douglasii* infections in *Pseudotsuga taxifolia* progress proximally as well as distally. *From author's summary*.

4550. HAWKSWORTH, F. G., and GILL, L. S. **Rate of spread of dwarf-mistletoe in Ponderosa Pine in the southwest**. *Res. Note Rocky Mt. For. Range Exp. Sta.* No. 42, 1960. pp. 2.

Based on measurements in 36 plots in Arizona and New Mexico. The first infections in a young stand are entirely from seeds ejected from dwarf-mistletoe (*Arceuthobium vaginatum* f. *cryptopodum*) plants in an old tree. The importance of the original tree as a direct source of infection declines with time. Lateral spread, or infection from seeds produced in the understorey, begins after 20–30 years. The mean spread from overstorey trees into dense 41-year stands was 51 ft. (1·2 ft./year); for open-canopied 34-year stands the spread was 59 ft. (1·7 ft./year). No relationship was found between compass direction and distance from seed source, which suggests that prevailing winds are not important in dissemination.

443. Fungi and Bacteria

See also Nos. 4081–92, 4611, 4617, 4619, 5049–50.

4551. HORSFALL, J. G., and DIMOND, A. E. [Editors]. **Plant pathology. An advanced treatise. Volume I. The diseased plant. Volume II. The pathogen**. Academic Press Inc., New York & London. (I) 1959. pp. xiv + 674; (II) 1960. pp. xiv + 715. Many refs. Price £7. 1*s*. 9*d*. per volume.

Volume I of this work, designed for the research worker, covers, in 15 articles by authors from many countries, the scope and history of the subject, the nature of pathological processes, defence mechanisms, predisposition, therapy, etc. Vol. II, also in 15 articles, covers the nature of pathogenicity and parasitism, multiplication and reproduction, inhibition (including fungicides and nematocides). A third volume on diseased populations is to follow. There are numerous illustrations from forest pathology.

4552. KUNTZ, J. E. **The use of radio active isotopes in tree disease research**. *Trees Mag., Ohio* 20 (2; 3), 1960 (16–7, 22–3; 8, 20). 18 refs.

A review of the American literature.

Fungi and Bacteria: Chemical Control

See Nos. 4505, 4555, 4557–8, 4585, 4589–90, 4593.

443.2. Diseases of Seed and Seedlings; Damping Off etc.

See also Nos. 4305, 4314, 4327.

4553. **Sitka seedling diseases**. *Extr.* from *Rep. Rothamst. Exp. Sta. 1959*, 1960 (107–8).

The development of micro-organisms on roots of Sitka Spruce seedlings taken from the nursery (started in 1925) at Kennington, near Oxford, was examined on 15 occasions through the growing season. Three distinct diseases occurred: (1) pre-emergence and immediately post-emergence damping-off, which was followed at midsummer by (2) a sudden browning of the plants; (3) during early autumn the plants became stunted but with no discoloration. The study was made on plots (*a*) treated with formalin, (*b*) treated with chloropicrin, and (*c*) untreated. Emergence in (*a*) was 44%, in (*b*) 33%, and in (*c*) 16%; counts of browned plants later, on 3 occasions, showed 6·4% in (*a*), 10·5% on (*b*), and 24·7% on (*c*); (3) was confined to (*a*) plots. All three diseases can occur on plots that have received formalin annually for 5 years, and evidence is adduced that pathogenic organisms may be introduced on seed. From isolates made from 13,200 root fragments, 96 fungi and bacteria were tested for pathogenicity to Sitka seedlings. Of these, *Pythium* spp., *Fusarium oxysporum*, and an unidentified bacterium caused symptoms similar to those observed in the field. From their seasonal occurrence it seems probable that (1) is caused mainly by *Pythium* spp., (2) by *F. oxysporum*, and (3) possibly by *F. oxysporum* and *F. roseum*.

4554. KAILIDIS, D. S. **Some aspects of the damping-off of Black Pine, *Pinus nigra* Arn.** *Abstr. of thesis*, in *Dissert. Abstr.* 20 (8), 1960 (3013–4). O.R.S.

The main pathogenic fungi isolated were 3 *Pythium* spp., *Rhizoctonia solani*, 3 *Fusarium* spp., and *Botrytis cinerea*. *Pythium perniciosum*, not pathogenic to Black Pine seedlings, was isolated from the soil. *Pythium* spp. grew best in culture at pH 5·5 and at 20–30° C. *R. solani* grew faster at pH 4·5–6·5 and satisfactorily at pH 8, and faster at 20–30°. *Fusarium* spp. were less affected by environment. In a 12-month study, *Pythium* was most, and *Rhizoctonia* least prevalent, with *Fusarium* intermediate, during winter in a closed, humid, well heated greenhouse. In spring and autumn, in a cooler environment, and in summer, both in the greenhouse and in the field, *Fusarium* was most prevalent and *Pythium* intermediate. *Fusarium* proved to be the main cause of damping-off in Michigan. Germination studies of Black Pine seed showed that moderate moisture is necessary at first, and that, after a few days, good aeration is the most critical factor. At pH 4·5 of the media, germination was twice that at 8·5. At constant temperatures, 24° and 31° gave optimum germination; alternating temperatures generally gave good results. Seedlings became resistant in 25–27 days after germination. Pre-emergence damping-off was higher in warmer than in cooler periods. There was more damping-off in seedlings grown at a medium rate in conditions of moderate soil fertility than in those grown faster in sand or slowly in a muck soil. Where seedlings grown in favourable conditions in the greenhouse or in the field suffered from root-rot, *Fusarium* spp. were the cause. Recommendations based on these results are made for Black Pine in nurseries.

4555. POMERLEAU, R., and NADEAU, I. Données nouvelles sur la fonte des semis de conifères dans le Québec. **[New data on the damping-off of conifer seedlings in Quebec.]** *Rep. Quebec Soc. Prot. Pl. 1959*, 1960 (27–42). 11 refs. [F.f.e.]

In Quebec forest nurseries 20–65% of conifer seedlings die each year after emergence, and probably even more succumb before emergence. The principal pathogens are one species of *Rhizoctonia* and several of *Fusarium* and *Alternaria*. Successful control measures include lowering the soil pH by application of dilute H_2SO_4 and pelleting seed with Captan 50W.

4556. GREEN, R. J., JR. **Seedling blight and root rot of *Taxus*.** *Amer. Nurserym.* 110 (10), 1959 (62–3).

An organism, tentatively identified as *Phytophthora cinnamomi* has been consistently isolated from diseased plants of *Taxus* spp. in nurseries in Indiana. In experiments at Purdue University on healthy, well rooted cuttings, transplanted into glazed pots and kept at a constant temperature of 70° F., series in which the plants were inoculated with *P. cinnamomi* and flooded, showed much more serious symptoms of seedling blight after 8 and 28 days than those inoculated only or flooded only. Recommendations for control are: selection of healthy plant stock for cuttings; steam sterilization of the sand used in rooting benches; use of composted soil containing no plant materials or soils from infected areas; choice of well drained, light soils for ground and field beds; and careful inspection and culling of stock at all stages.

4557. NOHARA, Y., ZINNO, Y., and SATO, T. **[Experiments on the control of damping-off of conifer seedlings (II).]** *Bull. For. Exp. Sta., Meguro, Tokyo* No. 119, 1960 (17–26 + 3 plates). 2 refs. [Jap.jap.e.e.]

[Cf. *F.A.* 19 No. 576.] Experiments were made at several nurseries in 1956–58 to compare the effect of (*a*) pyroligneous acid (p.a.), (*b*) H_2SO_4, (*c*) Uspulun, and (*d*) a double treatment involving p.a. application and soil burning, in the control of damping-off in seedlings, mainly of *Larix leptolepis*. Results (tabulated data given) indicated that the most effective control was achieved by (*d*), which also aided seedling growth, followed by (*a*) applied at 8 litres/sq. m., and soil burning only. Of the 3 chemicals, the decreasing order of effectiveness was (*a*), (*b*), (*c*), but further studies are required to confirm these conclusions.

4558. LIGHTLE, P. C. **Brown-spot needle blight of Longleaf Pine.** *For. Pest Leafl. U.S. For. Serv.* No. 44, 1960. pp. 6. 3 refs.

Discusses hosts, distribution, symptoms, life history, pathogenicity and control of *Scirrhia acicola*. Bordeaux mixture is recommended for nurseries, and controlled burning for plantations and natural regeneration. [Cf. *F.A.* 6 p. 191.]

443.3. Diseases of Older Stages

4559. SINADSKIJ, JU. V., and BONDARCEVA, M. A. Zabolevanija drevesno-kustarnikovyh porod v tugajnyh lesah Syr-Dar′i. **[Diseases of trees and shrubs in the riparian forests of the Syr-Darya flood-plain.]** *Bot. Ž.* 45 (3), 1960 (423–9). 4 refs. [Russ.]

Reviews some 20 species of injurious fungi [cf. *F.A.* 18 No. 1798], and some climbers (especially the parasitic *Cuscuta* spp.), and the damage they do to their host trees [cf. *F.A.* 20 No. 3388].

4560. ŽUKLYS, L. Naujai aptiktos Lietuvoje sumedejusių dekoratyvinių augalų ligos. **[Some new diseases of ornamental tree species in Lithuania.]** *Liet. TSR Mokslų Akad. Darb.* (*Ser. C*) No. 1 (21), 1960 (19–28). 5 refs. [Lith.russ.]

Reports damage by *Cryptospora* spp., *Sphaeropsis* sp., *Septomyxa rhois* and *Coryneum disciforme* on various native and exotic trees in parks in Lithuania.

4561. PIRONE, P. P. **Why shade trees die along city streets.** *Proc. 35th Nat. Shade Tree Conf. 1959*, 1959 (6–16). 4 refs.

Investigation of 330 dead or dying trees in New York and New Jersey city streets showed that 83% of them were *Acer platanoides* and another 10% were other *Acer* spp. The most commonly identified fungal parasites associated with affected trees were *Ganoderma lucidum*, *Verticillium albo-atrum*, and *Armillaria mellea*. Of the dead or dying *A. platanoides*, 72% were infected with fungi.

4562. BUTIN, H. Die Krankheiten der Weide und deren Erreger. **[The diseases of Willows and their pathogens.]** *Mitt. Biol. Bundesanst. Land- u. Forstw., Berl.* No. 98, 1960. pp. 46. 74 refs. [G.]

Covers bacteria and fungi recorded in Germany, mentioning a few other species, and discusses, with illustrations, the symptoms and injuries, appearance and biology of the pathogen, host susceptibility, control, etc.

Stem, Butt and Root Rots; Root Diseases

See also Nos. 4001, 4582, 4721.

4563. Orłoś, H. Badania nad funkcją ekologiczną grzybów z rodziny Polyporaceae w różnych typach lasu Białowieskiego Parku Narodowego. **[The ecological function of Polyporaceae in different forest types of the Białowieża National Park.]** *Prace Inst. Bad. Leśn.* No. 193, 1960. pp. 98. 30 refs. [Pol.russ.e.]

Lists, for each of 48 species (44 of them Polyporaceae) occurring in the park, the forest type(s) where found, date(s) of observation, location, tree species affected, and factors determining its ecological function. The *Carpinetum typicum*, *Querceto-Carpinetum* and *Fraxineto-Piceeto-Alnetum* were the types, and Spruce, Hornbeam and Birch the species, most seriously attacked. The 14 species of fungi most important ecologically were determined.

4564. Orłoś, H. Badania nad wysypami zarodników grzybów z rodziny Polyporaceae. **[Study of spore shedding in fungi of the Polyporaceae.]** *Prace Inst. Bad. Lésn.* No. 194, 1960. pp. 12. [Pol.russ.e.]

The times and amounts of spore shedding of *Fomes annosus*, *F. fomentarius*, *F. igniarius*, *F. marginatus*, *F. pini* and *Ganoderma applanatum* were determined throughout 1956 and 1957, and correlated with the weather (r.h. and temperature). Results are shown in charts.

4565. Toole, E. R. **Butt rot of southern hardwoods.** *For. Pest Leafl. U.S. For. Serv.* No. 43, 1960. pp. 4. 4 refs.

Briefly describes its occurrence and symptoms, and the life history and control of fungi causing it.

4566. Parker, A. K., and Johnson, A. L. S. **Decay associated with logging injury to Spruce and Balsam in the Prince George region of British Columbia.** *For. Chron.* 36 (1), 1960 (30–45). 7 refs.

In a study of decay associated with logging damage, 873 Spruce [*Picea glauca*] and Balsam [*Abies lasiocarpa*] trees with 2938 scars were examined. Scars averaged 5, 15, and 31 years old and were classified according to their position, size and depth. The relation of scar infection to locality, tree diameter, site, and to scar position, size, depth, and age was studied. The average volume of decay associated with scars of different types and ages was determined, and the fungi most frequently found associated with the decay are reported. *From authors' abstract.*

4567. Bartels, H. Hallimaschbefall in Fichtenbeständen des Sauerlandes. **[*Armillaria mellea* in Spruce stands in the Sauerland.]** *Allg. Forstzeitschr.* 15 (25), 1960 (354–7). 6 refs. [G.]

Describes observations in gaps, 10 to 80 m. in diameter, in 30- to 60-year-old stands, which showed that mortality had generally started in 1949 (possibly following the 1947 drought) reached a peak in 1950–53, and ceased in 1956. It is suggested that the fungus, which could be traced to Oak stumps of a former coppice in the centre of the gaps, lost its virulence with distance or with transfer to conifer stumps, for new foci appearing after 1953 seemed to rule out the weather as a reason for subsidence. In general, extreme weather conditions, particularly wet seasons, favoured the attacks.

4568. Due, J. E. Om Trametes, planteafstand og hugst ved 1. generation rødgran på let jord. **[Rot, plant spacing and thinning of first-generation Norway Spruce on light soil.]** *Dansk Skovforen. Tidsskr.* 45 (3), 1960 (125–39). [Dan.]

In Danish forestry 'Trametes' has recently been used for various fungi, the most important being *Fomes annosus*, *Armillaria mellea*, and *Polyporus albidus*; in practice, a tree is called 'Trametes-attacked' whenever staining and wood destruction occur, and this sense is used here. Data are presented from stands in the Løvenholm forest district showing a decrease in 'Trametes' attack with increasing plant spacing in the range 1·25 × 1·25, 4·5 × 1 and 8 × 1 m. It is concluded that, for medium-quality soils, a wider than normal plant spacing (e.g. 3 × 1·25 m.), plus interplanting with Broom and only light thinning, may reduce the incidence of 'Trametes' without unduly affecting wood quality or timber volume.

4569. Low, J. D., and Gladman, R. J. ***Fomes annosus* in Great Britain; an assessment of the situation in 1959.** *For. Rec. For. Comm., Lond.* No. 41, 1960. pp. 22 + 13 photos, 4 dgms., 4 sketchmaps. 20 refs.

Subjects covered include: factors in infection and development; the present position in Britain in relation to previous forest history; the increase of attack in successive rotations; the spread of infection into new areas; the rate of development; the mechanism of infection; killing attack; the effect of species and site on attack; crop protection; the assessment of risk. It is concluded that, if no measures are taken to prevent it, *F. annosus* attack will establish itself through most of the new conifer plantations in Britain. It is therefore desirable to assess the present status and the future danger of the disease in each forest or estate. In all forests and plantations where the *Fomes* position appears in any way dangerous, in all plantations on land with a history of agricultural tillage, and in all plantations of *Tsuga heterophylla*, stump protection could with advantage be introduced. It is considered that the adoption of stump treatment as a general measure of crop protection would be justified in all conifer plantations except on sites that previously carried pure hardwood crops or those having a wet, acid, peaty soil.

4570. Orłoś, H., and Dominik, T. Z biologii huby korzeniowej—*Fomes annosus* (Fr.) Cooke. **[The biology of *F. annosus*.]** *Sylwan* 104 (1), 1960 (1–13). 5 refs. [Pol.russ.e.]

Reviews the problem of *F. annosus*, with special reference to Poland, where it does considerable damage, especially to Pine ca. 30–40 years old planted on (1) unsuitable soils, or (2) old agricultural land. The authors consider isolation ditches, creosoting of stumps, etc. to be expensive and ineffective, and advocate growing Birch, Aspen, Willow and Poplar on (1) and (2) for 30–40 years, before inoculating with soil from old forest areas and planting up with Pine and Spruce.

4571. **Root rots.** *Extr.* from *Rep. Ntheast. For. Exp. Sta. 1959*, 1960 (45–8).

Rate of spread was studied on two severe *Fomes annosus* infection centres in a *Pinus resinosa* plantation. The infection centres were 8 and 10 years old, and the focal point of each was known. The annual rate of radial spread was calculated at 5·4 ft. for the 10-year-old infection, and 6·8 ft. for the 8-year-old. All conditions were very favourable for the rapid spread of the disease. Recent observations cast some doubt on the general supposition that localized spread of *F. annosus* does not occur unless continuous woody material is present in the soil [cf. *F.A.* 20 No. 710]. In one study plot an abundance of *F. annosus* was found fruiting on the litter surface. There were 5 stumps and 2 standing dead Red Pines within a 144-sq.-ft. area containing 45 such fruiting bodies, but only 5% of the latter showed signs of being connected with Pine roots; the more distant of these fruiting bodies were ca. 17 ft. from the nearest dead tree and even further from any of the stumps. Careful examination and dissection yielded no definite information on the main substrata utilized by the fungus. It seemed in some cases to be saprophytic on Red Pine bark fragments, on Red Pine twigs in the litter, and on dead branches of Wild Cherry lying on the ground. Only occasionally were the dissected masses interpreted as being parasitic or saprophytic on Red Pine roots still attached to stumps or standing trees.

4572. **Root rot.** *Sth. For. Pest Reptr. Sth. For. Exp. Sta.* No. 27, 1959 (5).

Fomes annosus killed many of the Loblolly Pines left after thinning in a Mississippi plantation [age not stated].

4573. Ch'ên, S.-C. **[Preliminary study on white heart rot of *Picea* spp. in the Hsiao-chin [Siaokin] river basin.]** *For. Sci., Peking* 1960 (2), (132–49). 13 refs. [Chin.chin.e.]

The incidence of infection by *Trametes* [*Fomes*] *pini* var. *abietis* in the basin varies from 10·6 to 29·7%. Sporophores usually appear on the E. side of stems, and on average the rot spreads upwards 9·2 m. more than downwards from the point of infection. The youngest trees infected are 115 years old. The infection is spreading at higher altitudes and on shady slopes, and its incidence increases with the age of the forests—more so in pure Spruce forests than in mixed ones. *P. asperata* is more resistant than *P. purpurea*. Height and diameter increment of infected trees decline, and yields from infected trees average only 25·4% of sound tree volume. Measures advocated are: felling infected trees; general forest protection; establishment of mixed forests; and pruning.

4574. Krstić, M. O odnosu broja karpofora *Ungulina fomentaria* Pat. i obima truleži bukovih debala u južnom Kučaju. **[The relationship between the number of sporophores of *U. fomentaria* [*Fomes fomentarius*] and the extent of decay in Beech stems in Južni Kučaj.]** *Zašt. Bilja* No. 47/48, 1958 (185–8). [Serb.e.] I.M.I.

It was found in an analysis of 18 Beech stems that, where sporophores appeared at a height of 0·2–4 m. above the ground, regardless of numbers, decay reached (with one exception) to the base of the stem. In 14 stems the section below the lowest sporophore was completely useless. Damage to the section above the highest sporophore varied both in extent upwards and in volume of wood destroyed. The volume of decayed wood had a tendency to increase with an increase in numbers of sporophores, but not necessarily proportionately, being affected also by frost and sun-scorch. Decay in stems bearing a greater number of sporophores was found to be at a more advanced stage.

4575. Mikalaikevičius, V. Kai kurie drebulinės pinties (*Phellinus tremulae* Bond. et Boriss.) biologijos klausimai. **[On the biology of *P. tremulae*.]** *Liet. Miškų Ūkio Moksl. Tyr. Inst. Darb.* No. 3, 1958 (187–203). 8 refs. [Lith.russ.] [Cf. *F.A.* 21 No. 2000.]

4576. Bagchee, K. **Fungal diseases of Sal (*Shorea robusta* Gaertn.) V. The heart-rot of Sal caused by *Trametes incerta* (Curry) Cooke.** *Indian For. Rec.* (*n.s.*) *Mycology* 2 (4), 1959 (57–69 + 2 plates).

[Cf. *F.A.* 19 No. 4412.] The distribution, symptoms, biology, pathology, and cultural characteristics of the fungus are described and control methods suggested. It is responsible for serious loss in the virgin stands in Central India, where it is also associated with *Fomes caryophylli* in injury to natural regeneration.

4577. Dadant, R. Une méthode d'évaluation des sensibilités des espèces ligneuses au pourridié provoqué par le *Clitocybe tabescens*. **[A method of evaluating the susceptibility of wood species to decay caused by *C. tabescens*.]** *C. R. Acad. Agric. France* 46 (2), 1960 (74–7). [F.] A.P.B.

Chips from bark and sapwood of fresh, sound roots were immersed in water (300 g. chips to 500 g. water) and left at room temperature (30° C.) for 24 hours. They were then autoclaved for 30 min. at 1 kg. pressure and afterwards filtered through a metal sieve of ca. 1-mm. mesh. The filtrate was poured into Erlenmeyer flasks sterilized in the autoclave (20 min. at 1 kg.), and finally inoculated with a strain of *C. tabescens*. After 1 month at room temperature (30° C.) any growth was removed, washed, dried and weighed, the weight of the culture serving as an index of the susceptibility of the species. In this way it was confirmed that *Inga dulcis* and *Terminalia perieri* [*pierrei*?] are resistant and *Leucaena glauca*, *Albizzia lebbek* and *A. stipulata* are susceptible to attack by *C. tabescens*.

4578. **Root disease of Spruce on heavy soil.** *Extr.* from *Rep. Imp. For. Inst., Oxf. 1958/59*, 1959 (14).

In Central Wales an interesting decline in vigour occurred in Sitka Spruce planted 20 years earlier on a heavy clay soil. It was plain that poor aeration was largely responsible for failure to maintain a satisfactory root development. *Pythium* species were, however, isolated from the soil, and experiments in inoculation of water cultures of Sitka Spruce, Douglas Fir, and Corsican Pine indicated that in some circumstances *Pythium* spp. can cause a chronic disease which results in death of the finer roots and debility of the trees.

Wilts, Diebacks etc.

4579. Schwarzkiefernsterben in Niederösterreich. **[A fatal disease of *Pinus nigra* var. *austriaca* in Lower Austria.]** *Holz-Kurier, Wien* 15 (14; 17), 1960 (1–2; 9). [G.]

Reports on a serious attack by a fungus identified as *Brunchorstia pini* [? *Crumenula* (*Scleroderris*) *abietina*, cf. *F.A.* 18 No. 1327]. It is estimated that ca. $\frac{1}{6}$ of the Black Pine of the region will have to be felled, and the army has been called in to expedite the work of felling and slash burning so as to prevent spreading of the disease and attack by bark-beetles. The outbreak, characterized by red or yellow discoloration of the needles and dying back of shoots, is thought to be a result of the abnormal summer of 1959, which was wet at first (causing shoots to grow rapidly) and later dry and hot, weakening the trees.

4580. Tomašević-Grujoska, M. Problem sušenja bora u NR Makedoniji. **[The problem of Pine dieback in Macedonia.]** *Zašt. Bilja* No. 47/48, 1958 (105–8). [Serb.g.] I.M.I.

Reports for the first time the occurrence of *Cenangium abietis* in Pine plantations in Macedonia. The disease, first noted near Bitolj, has attacked *Pinus peuce*, *P. nigra* and *P. alba* in the Pelister National Park and the Kičevo, Berovo and Kruševo regions. The primary cause of dieback was considered to be drought, with *C. abietis* as a secondary complication. Trees affected were felled and removed as a measure of control.

4581. Higgins, D. J. **The utilization of glucose carbon by five isolates of the fungus *Ceratocystis ulmi*.** *Abstr. of thesis*, in *Dissert. Abstr.* 20 (9), 1960 (3485). O.R.S.

An investigation of the relative quantities of metabolic C products formed from glucose during growth. A strain of *C. ulmi*, atypically pathogenic to a resistant strain of *Ulmus carpinifolia*, was outstanding among isolates tested in total acidity and in the % of C in the non-volatile acid category. This category may contain a toxin accounting for the unusual pathogenicity: it merits further investigation.

4582. Shigo, A. L. **Fungi isolated from Oak-wilt trees and their effects on *Ceratocystis fagacearum*.** *Mycologia* 50 (5), 1958 (757–69). 8 refs. O.R.S.

[Cf. *F.A.* 19 No. 604.] In 1956–57 more than 400 trees infected with Oak wilt in West Virginia were sampled. Ca. 5000 cultures were examined from 1158 samples, taken mainly from deeply girdled trees. The fungi most frequently associated with trees killed by *C. fagacearum* were identified, including representatives of > 50 genera. Some isolates were antagonistic to *C. fagacearum* in mixed cultures, while others were not. *Hypoxylon punctulatum* was often isolated from deeply-girdled trees, where it causes a rapid sapwood decay. Where its stromata were observed, *C. fagacearum* mats appeared to be absent.

4583. Donley, D. E. **Studies of wood boring insects as vectors of the Oak wilt fungus.** *Abstr. of thesis*, in *Dissert. Abstr.* 20 (10), 1960 (4220). O.R.S.

Insects developing on trees killed by Oak wilt fungus were reared at the Central States Forest Experiment Station, and *Chrysobothris femorata*, *Urographis fasciatus*, *Pseudopityophthorus minutissimus* and *Neoclytus scutellaris* were selected for use in inoculation studies. They were contaminated with a (conidial) spore suspension of the fungus to simulate inoculum that might be present in the fungus mats, and were then allowed to feed on unwounded seedlings of *Quercus rubra*, *Q. alba* and *Q. palustris* in greenhouse tests. The fungus was recovered from 5 (out of 134) seedlings exposed to *C. femorata*, 16 (135) exposed to *U. fasciatus*, and 14 (135) exposed to *P. minutissimus*, but no 'takes' were recorded from *N. scutellaris*. Two inoculations were recorded in field tests in which unwounded nursery stock was exposed to single insects contaminated with a suspension of conidia; the foliar symptoms in these two inoculations appeared 12 months after exposure to the insects, *U. fasciatus* ♀s. Viability of the conidia appears to last at least 48 hours when the spores are placed on the bodies of wood-boring beetles.

4584. **Root grafts in Oak.** *Extr.* from *Rep. Cent. St. For. Exp. Sta. 1959*, 1960 (2–3).

Rubidium^{86}chloride, $CuSO_4$, azosulphamide, and a white strain of the Oak wilt fungus have been used in Missouri as tracers for locating root grafts. Results show that ca. 15% of all Black and White Oaks are connected by root to adjacent trees. Excavation of the roots of > 40 trees showed that many apparently firm grafts are only superficial; unions of the tissues, especially of the vascular elements, are rare. This may explain why only a few of the experimental tracer-located grafts have so far served as channels of disease transmission. Study is now in progress on the possibility that the disease may be spreading through roots that are near each other but not united.

4585. **Disinfestation of Oak wood [infected with Oak wilt fungus].** *Extr.* from *Rep. Cent. St. For. Exp. Sta. 1959*, 1960 (3).

Because of the possibility that Oak wilt fungus may be carried in Oak lumber, some countries have restricted imports of Oak from the U.S.A., so a simple, inexpensive way to disinfect Oak products on a commercial scale is being sought. As a preliminary, 15 fumigants have been tested in a chamber designed to approximate to the conditions of unpressurized field application. Heavily infected stem sections (3–4 in. in diam., and 8 in. long) of Black and White Oak, were exposed to air saturated with the vapours of the various chemicals at ca. 70° F. MeBr and chloropicrin killed the fungus in all parts of the infected wood within 3 days. Propylene oxide was effective within 7, but not within 3, days. CCl_4, formaldehyde, 3,5-dimethyltetrahydro-1,3,5,2H-thiadiazine-2-thione, and NaMe dithiocarbamate were partially effective but did not kill all the fungus within 7 days. Acetone, CO_2, Cl, C_2H_4 Br_2, MeOH, N, and xylol were ineffective.

4586. KAUL, R. N. **Dying of *Eucalyptus gomphocephala*.** *Indian For.* 86 (3), 1960 (177–8).

Describes a wilt of *E. gomphocephala* both in the nursery and in the field, at Jodphur, believed to be due to a *Fusarium* sp.

Cankers, Stem Rusts etc.

See also Nos. 4054, 4272, 4275, 4511, 4719, 4913.

4587. HOPKINS, J. C. **The locus of entry of the canker fungus *Atropellis piniphila* into Lodgepole Pine stems.** *Bi-m. Progr. Rep. Div. For. Biol. Dep. Agric. Can.* 16 (2), 1960 (3). 1 ref.

The points of entry of 53 stem cankers on *Pinus contorta* var. *latifolia* at Kanakaskis, Alberta, were determined by sectioning through the estimated centre. Of these, 5 showed sufficient branch penetration to suggest that they may have originated from branch infections close to the stem. Two others had originated at cone/stem junctions. The remaining 46 cankers had originated from stem infections at or within 1 cm. of branch nodes; 13 at the lower surfaces of branch/stem junctions; 22 on stem tissue between branches but still within the nodal zone; the exact point of entry of the remaining 11 could not be determined. For lack of histological evidence, it is uncertain whether the pathogen can penetrate unwounded bark. Two incipient cankers were, however, noted where no visible damage had occurred to the bark at their points of origin. [Cf. *F.A.* 15 No. 2512.]

4588. MAGNANI, G. Ricerche sulla necrosi corticale del pioppo da *Dothichiza populea* Sacc. et Briard. **[Bark necrosis of Poplars caused by *D. populea*.]** *Pubbl. Cent. Sper. Agric. For., Roma* No. 3, 1959 (1960), (77–126 + 5 plates, 2 tbls.). 47 refs. [It.it.e.*e*.]

Detailed report on laboratory and field studies in Italy. Mycelium and conidia both survived temperatures as low as −25° C. for 36 days but were killed at +40°. Artificial inoculations on a number of *Populus* spp. succeeded at low temperature, but in healthy trees the histological reactions of the host soon limited fungal development. It is concluded that there may be different strains of the fungus, which might partly account for the greater severity of attacks in Central and Northern Europe.

4589. AERTS, R., SOENEN, A., and BEAUDUIN, E. Essais de lutte contre le Dothichiza du peuplier (*Dothichiza populea* Sacc. et Br.). **[Experiments in the control of *D. populea*.]** *Repr.* from *Agricultura, Louvain* (*Sér. 2*) 7 (2), 1959 (269–87). 21 refs. [F.f.du.e.g.] I.M.I.

Experiments were undertaken in the nurseries of the Union Allumettière at Léau (Zoutleeuw) to investigate the possibilities of chemical control of *D. populea*, to determine the critical infection period and the frequency of treatments, and to test different chemicals, viz. (*a*) a mixture of carbamates and Urbacide, and (*b*) basic Cu_2OCl_2. Some preliminary results are presented. Although the tests are not complete, the following conclusions can already be drawn. (1) Good results may be obtained with chemical treatments during the growing season. (2) The most dangerous time for infection begins with flushing and may extend throughout the spring and part of the summer. (3) Disinfecting the cuttings is useful, but infection is liable to recur so long as they remain in the nursery. (4) Symptoms tend to appear some time after infection, usually after the plants have left the nursery. (5) In the conditions of the experiments no evidence was obtained that infection takes place in autumn or winter. (6) Delay in transplanting does not aggravate the disease.

4590. DAHTE, A. Vorbeugung gegen *Dothichiza*-Befall der Baumschulpflanzen durch Chemikalienspritzung. **[Preventing *Dothichiza* attack on nursery plants by chemical sprays.]** *Holz-Zbl.* 86 (67), 1960 (934). [G.]

Summarizes a paper read at the 1960 meeting of the Bavarian Section of the German Poplar Society. Four sprayings, from July to Sept., with 0·3% Brestan (Zn acetate), 0·75% "Cupravit blau" (copper hydroxide), or 0·3% "Kupferoxydul ultra" (cuprous oxide) gave good control of rust on 1 + 2 or 2 + 2 *Populus* × *robusta* plants, and the following spring ⩾ 90% were free from *D. populea*, compared with 8% of controls. Spraying with 0·1% 'Quecksilber Bayer' (a mercury preparation) had no effect. None of the sprays was phytotoxic.

4591. GRAVES, A. H., and JAYNES, R. A. **Chestnut breeding—Report for 1958, and 1959: Further on inarching.** *Rep. Nth. Nut Growers' Ass.* No. 50, 1959 (68–9).

[Cf. *F.A.* 14 No. 449.] With reference to their method of 'by-passing' diseased bark in Chestnuts attacked by *Endothia parasitica*, by inarching basal shoots, the authors stress the importance of removing side shoots from the inarched shoot as soon as the graft has taken, and cutting the string or covering over the graft.

4592. **Climate, elevation, airflow influence blister rust spread.** *Extr.* from *Rep. Wis. Agric. Exp. Sta.* 1958 (38–9).

[Cf. *F.A.* 18 No. 587.] To test the relation of temperature to rust, blister-rust cankers were grafted on to disease-free nursery stock of Pine [*Pinus strobus*]. They tended to die out on trees held at a constant temperature of ca. 82° F., whereas those grafted on to trees held at lower temperatures (75°, 68° and 61°) lived. Site elevation seems to have a distinct connexion with the distribution of the disease in the southern part of the state. It was found that below 900 ft. there was practically no rust on Pine; at 900–1000 ft. it was found only in locally cooled sites; at 1000–1100 ft. the rust was present in all such locally cooled sites and often in other areas; at 1100–1200 ft. it was found on Pines in most sites, and above 1200 ft. the disease appeared on all sites and was occasionally severe. The average August daily maximum temperature (important for spore fertility of *Cronartium ribicola*) decreased by ¾ of a degree for each 100 ft. of increase in elevation; the higher elevations also have heavier rainfall. Work was done with smoke bombs to trace the movement of air currents that can carry spores from the *Ribes* hosts to Pines. These confirmed previous findings that the air rises from swamps to high ground and that, at night, air moves horizontally from the cold open ground into the warmer air under the trees and then up through the tops of the crowns.

4593. **Oak leaves hold key to fungus spread.** *Extr.* from *Rep. Wis. Agric. Exp. Sta. 1958*, 1959 (10).

Experiments have shown that the leaves of Oak (the alternate host of *Cronartium quercuum*, which causes Eastern gall rust in *Pinus banksiana*) become resistant to the fungus as they mature. Leaves 4–11 days old are highly susceptible, but those > 25 days old are completely resistant. The age of the Oak leaves is, therefore, a limiting factor in the build-up on Oak of inoculum available for the infection of Pine. Another factor necessary is a period of 12 hours with relative humidity of 100% accompanied by free moisture on the leaves. Experiments with fungicides to control the rust in the nursery showed that zineb gave 84% control, Ferbam 80%, and ziram 75%.

Foliage Diseases

See also No. 4274.

4594. ***Lophodermium pinastri* (Schrad. ex Fr.) Chev.** *Distr. Maps Plant Dis.* No. 371, 1960. pp. [2].

4595. MORIONDO, F. Sul disseccamento degli aghi di pino cembro in Alto Adige. **[Needle blight of *Pinus cembra* in the Upper Adige valley.]** *Ann. Accad. Ital. Sci. For.* 8, 1959 (43–57 + 2 plates). 30 refs. [It.f.]

Describes a disease caused by *Phacidium pinicembrae* [cf. *F.A.* 19 No. 3176].

4596. FERGUS, C. L. **The influence of environment upon germination and longevity of aeciospores and urediospores of *Coleosporium solidaginis*.** *Mycologia* 51 (1), 1959 (44–8). 8 refs. O.R.S.

Experiments on aecia from *Pinus rigida* needles and urediospores from *Solidago caesia* showed optimum temperature for germination to be ca. 20° C. The maximum is between 30 and 35°, and the minimum < 6°. The minimum time required for formation of germ tubes was 16 hours at the optimum temperature.

4597. BOYER, M. G. **Observations on foliage diseases of introduced Poplars.** *Bi-m. Progr. Rep. Div. For. Biol. Dep. Agric. Can.* 16 (2), 1960 (1–2).

A mixed plantation of introduced Poplars in Quebec was examined periodically in summer 1959 for the presence of foliage disease. Height measurements were taken to determine the period of active growth, and the initial appearance of each disease was recorded during inspections made twice weekly. When 100% of foliage was diseased, estimates were made of the total leaf area involved. The period required to reduce the healthy leaf area by 25% was noted—a reduction reached well within the period of active growth by e.g. an unidentified disease on *P. tremuloides* × *P. tremula* and *Marssonina populi* on *P. deltoides* × *P.* "Volga". A tendency was observed for specific diseases to increase in both intensity and host range after the decline in seasonal growth. This suggests a response of the pathogen to physiological changes in the host reflected in a lowering of resistance. The performance of Poplars graded for resistance by inoculation tests during summer 1958 was also investigated. Three hybrids, *P. nigra* var. *betulifolia* × *P.* "Volga", *P. deltoides* × *P.* "Volga", and *P. charkowiensis* × *P. robusta* were all graded as susceptible to *M. populi*. Their response under field conditions was, however, highly variable, emphasizing the importance of field observations in conjunction with inoculation tests when selecting disease-resistant hybrids.

4598. SATO, K., and SHOJI, T. **[Primary infection of anthracnose on Black Locust seedlings caused by the seed transmission of *Guignardia robinae* K. Ito et T. Kobayashi and the control by seed treatments.]** *Bull. For. Exp. Sta., Meguro, Tokyo* No. 119, 1960 (1–15 + 4 plates). 27 refs. [Jap.e.*e.*]

Describes isolation tests with *Robinia pseudoacacia* seeds infected by *G. robiniae* [see *F.A.* 21 No. 2019], which was found to adhere not only to the surfaces of the seeds but also to be dormant in their tissues. Various methods of disinfection were examined, including the soaking of hard seeds for 5 min. in water at 70° C., but no conclusive results were obtained.

4599. YEH, C.-T., and KATSURA, K. **[On a new *Pestalotia* disease of the leaf of *Quercus glauca* Thunberg and its causal fungus.]** *Sci. Rep. Kyoto Prefect. Univ.* (*Agric.*) No. 11, 1959 (52–8 + 1 plate). 6 refs. [Jap.jap.e.]

Describes the morphological and physiological characters of *P. kasagiensis* Yeh et Katsura sp. nov., and presents the results of inoculation experiments, which indicated damage on *Q. glauca*, *Q. dentata*, *Castanea japonica*, *Thea sinensis*, and *Eriobotrya japonica*, but none on *Diospyros kaki* and *Ficus carica*.

4600. KURTZMAN, R. H., JR., and STESSEL, G. J. **Elm cottony tip blight.** *Abstr.* in *Phytopathology* 50 (4), 1960 (240).

A hitherto unobserved fungus disease appeared in late May, 1959, on 20% of the trees in Elm plantations at Kingston, Rhode Island. Abundant white, cottony, extramatrical mycelium development resulted in blighting of leaves and twigs. Only the current season's growth was affected and the collapsed terminals remained hanging from older branches. Three to five days after the appearance of cottony growth, black sclerotia 2–7 mm. in diameter formed in the mycelium. The disease was reproduced by inoculation of pure culture isolates into seedling Elms under moist conditions. Above-normal moisture conditions favoured initial disease development; heavy dew occurred on each of the previous 12 mornings, and relative humidity continuously exceeded 90% during the 4 days before first observation. Since the fungus has so far failed to form other definitive structures, it can only be referred to the form genus *Sclerotium*.

444. Virus Diseases

4601. KRISTENSEN, H. R. Virussygdomme hos forstplanter. **[Virus diseases of forest species.]** *Dansk Skovforen. Tidsskr.* 45 (4), 1960 (155–66). 27 refs. [Dan.]

Discusses the symptoms, spread of disease and control of Elm mosaic, Elm zonate canker, Birch dieback, Poplar mosaic, Mountain-Ash variegation, Maple mosaic, and Ash witches' broom, drawing mainly on information from European and N. American sources.

4602. CORTE, A. Il 'mosaico' del pioppo. **[Poplar mosaic disease.]** *Monti e Boschi* 11 (3), 1960 (127–30). [It.f.e.]

Reports on a mosaic observed on both young and mature cultivated Poplars in the provinces of Pavia, Alessandria, and Turin. Similar to a disease reported from Bulgaria, Jugoslavia and the Netherlands [cf. *F.A.* 13 No. 4004], it has been experimentally transmitted by means of tissue grafts on young plants of clone I.C.4, but clone I.214 appeared to be resistant. The infected plants displayed 30% less girth increment than controls.

4603. IYENGAR, A. V. V. **The relation of soil nutrients to the incidence of spike disease in Sandalwood (*Santalum album* Linn.).** *Indian For.* 86 (4), 1960 (220–30). 30 refs.

Determinations of the mineral content of different parts of (*a*) healthy and (*b*) diseased plants indicated a deficiency of Ca in the vegetative organs of (*b*), but a high N content. This Ca deficiency is attributed to defective translocation from roots damaged (and finally killed) by the virus. The Ca content of soil under (*b*) is higher than under (*a*), suggesting that Ca is normally drawn directly from the soil through root-ends, but accumulates under (*b*). The same is believed to apply to K. The high N content of vegetative organs coincides with low N content in the roots. Since soil analysis shows no evidence of N depletion or accumulation under (*b*), it is concluded that the parasitism of *S. album* is differential in character, nutrients being drawn from both host and soil. [Cf. *F.A.* 20 No. 2028.]

45. Damage by Animals

451. Mammals

See also Nos. 4004–5, 4186–7, 4365, 4721.

4604. THALENHORST, W. Deutsche Forstschutz-Literatur 1958. 1. Wildschäden. **[German literature on forest protection in 1958. 1. Damage by wild mammals.]** *Z. PflKrankh.* 67 (4), 1960 (219–21). 11 refs. [G.] E.M.B.

Reviews 11 articles published in German forestry periodicals in 1958 on the nature of the damage done by deer, rabbits, hares, etc., control by reducing stocks, improving food supplies, and protecting the plants, and questions of compensation.

4605. BURNS, R. M. **Copper carbonate—boon or bane.** *Tree Plant. Notes* No. 40, 1960 (5–6).

$CuCO_3$, frequently used to repel rabbits from Southern Pine seedlings when planted out, appears to cause high mortality to the seedlings. In recent tests with *P. taeda* seedlings, 5 separate repellents containing $CuCO_3$, each mixed with a different sticker, were applied by high-pressure spray in the nursery, and the treated seedlings were then lifted, baled, transported to the planting site and planted out within 48 hours. At the end of the growing season, mortality of treated seedlings was 30–50% vs. 9% for untreated controls. Seedlings treated with $CuCO_3$ in asphalt emulsions (the most frequently recommended repellent) suffered most (50% mortality). When seedlings were top-dipped or sprayed on the planting site immediately before planting, damage was much less.

4606. BLAIR, R. M., and LANGLINAIS, M. J. **Nutria and swamp rabbits damage Baldcypress plantings.** *J. For.* 58 (5), 1960 (388–9).

In a trial in a clear-felled swamp near Cypremort, La., where previous plantings of *Taxodium distichum* had failed completely, 2100 seedlings were planted in Jan. 1957. By May, 90% had been uprooted and the bark of the taproots eaten. Others were browsed at varying heights. Three possible repellents applied to some seedlings failed. Though nutria (*Myocastor coypus*) had not previously been suspected, two adults were confined in an enclosure planted with *T. distichum*, half of which was flooded and half left unflooded. After 15 days, 59% of 300 seedlings in the flooded half were uprooted vs. 13% of 300 in the unflooded part, mostly near the water. Two different repellents again failed to reduce losses. The above-ground parts of the seedlings were not eaten, though a few had been roughly bitten. Clean browsing of seedling stems at a 45° angle, observed generally on unflooded sites, was attributed to swamp rabbits (*Sylvilagus aquaticus*). The Soil Conservation Service has recommended that until control measures can be formulated, planting of *T. distichum* in coastal areas of Louisiana should be suspended.

4607. MEHL, S. Notwendigkeiten und Schwierigkeiten bei der Organisation der Bekämpfung der Schermaus (*Arvicola terrestris* L.). **[Necessities and difficulties in organizing the control of *A. terrestris.*]** *Anz. Schädlingsk.* 33 (5), 1960 (70–4). [G.]

Reviews methods used in control (including descriptions of some traps) and discusses the planning and organization of control measures.

4608. WACHTENDORF, W. Untersuchungen über die Bekämpfung der Erdmaus *Microtus agrestis* mittels Giftköder. **[Control of *M. agrestis* with poison bait.]** *Zeitschrift für angewandte Zoologie, Berlin* 45 (4), 1958 (484–96). 11 refs. [G.g.e.] L.S.

In laboratory tests, Zn_3P_2 and Promurit [no specification] proved the most effective poisons, and *Crataegus* berries the preferred bait, though many others were accepted. In field tests, poisoned carrots and sunflower kernels were freely accepted.

Costs of baiting, estimated at DM7/ha., are ca. 10–15% of those of toxaphene treatment.

4609. KÜTHE, K., and KRÄMER, K. Schäden durch Rötelmaus (*Clethrionomys glareolus* Schreb.) und Erdmaus (*Microtus agrestis* L.) im Forst. **[Damage by *C. glareolus* and *M. agrestis* in the forest.]** *Anz. Schädlingsk.* 33 (6), 1960 (92–3). 3 refs. [G.]

Describes severe damage in a dense Spruce stand 3–4 m. tall. Leaders and side shoots were in some cases barked up to a height of 2 m., and in others, girdled. Both species of vole were found to be present, the high damage being presumably caused by *C. glareolus*. Even after spraying (toxaphene 4–6 litres/ha. or endrin 1–1·5 litres/ha.) damage still occurred. When treating for *C. glareolus*, high concentrations must be used, spraying the trees up to a height of 1 m. For *M. agrestis* alone it is sufficient to treat the grass cover.

4610. **The grey squirrel: a woodland pest.** *Leafl. For. Comm., Lond.* No. 31 (rev.) 1960. pp. 18. Price 1*s*. 6*d*. [Cf. *F.A.* 15 No. 428.]

4611. VASIĆ, M. Štete od visoke divljači u kulturama topola. **[Game damage in Poplar plantations.]** *Zašt. Bilja* No. 51, 1959 (31–8 + 6 photos). 4 refs. [Serb.e.] I.M.I.

Reports on damage by deer to the extensive Poplar plantations in Podunavle and Potisje forests, Vojvodina. Up to 80% of trees aged 1–4 years are affected. Types of damage are described and factors causing secondary damage to weakened plants are discussed, with lists of the most injurious insects and fungi.

4612. SEISKARI, P., and SUOMUS, H. **Felling Aspen and the management of Aspen stands for winter food for game.** *Suomen Riista, Helsinki* 12, 1958 (21–42). [Fi.e.] From *abstr.* in *Biol. Abstr.* 35 (8), 1960 (No. 20335).

Experiments showed that hare and elk collect to feed where Aspen are felled, and that elk can be kept away from Pine seedling stands by making Aspen available. For continuous winter feeding, felling must be planned so that an average of only $\frac{1}{40}$ of the Aspen of an area is taken.

4613. GRISEZ, T. J. **Slash helps protect seedlings from deer browse.** *J. For.* 58 (5), 1960 (385–7). 6 refs.

A statistically controlled survey of tree reproduction in relation to logging slash and deer was made 5 years after a heavy cutting in a Black Cherry/Beech/Maple stand on the Pocono Experimental Forest, Pa. Substantially larger numbers of stems of the commonly browsed species were found in the slash piles than in the intervening openings, and much less of the reproduction was browsed in the slash.

4614. SOMMER, H. G. Zaunbau im Forstbetrieb. **[Fence construction in forest management.]** *Forstarchiv* 31 (3), 1960 (23–4). 2 refs. [G.]

Discusses lay-out, labour and tools, quantity and kind of fencing material required, and stile and gate construction, with an analytical table of costs for four approved types of fence, against game.

4615. TURNER, G. T. **A lay-down fence for snow country.** *Repr.* from *Journal of Range Management, Portland* 13 (1), 1960 (43–4).

Describes a fence that can be laid down as a unit, to avoid snow damage, by releasing wire loops attaching it to support posts. The fence is held under tension with guys at all times, and can be laid down or put up simply and quickly by one man. Initial cost is somewhat higher than standard fencing, but on Black Mesa, W. Colorado, it has reduced maintenance costs by two-thirds.

452. Birds

See No. 4003.

453. Insects

See also Nos. 4000, 4611.

4616. SZMIDT, A. Forstentomologische Probleme in Polen. **[Forest entomological problems in Poland.]** *Anz. Schädlingsk.* 33 (6), 1960 (81–3). 3 refs. [G.]

Describes briefly the organization of forest protection in Poland, and gives short notes on the chief outbreaks (mainly in Pine and Spruce forest) and control measures taken since 1951.

4617. **A summary of current forest pest problems for New York State 1956–58.** Extension Department, State University College of Forestry, Syracuse, N.Y. [1959?] pp. 22. 29 refs.

Includes a list of insects and pathogens, enumerating general problems (surveys, identification etc.), and specific problems (by insect, fungus, etc.), and the agencies chiefly concerned in research thereon, with some notes on results, further research needs, literature available, etc.

4618. MASUTTI, L. Reperti sull'entomofauna del *Pinus nigra* Arn. var. *austriaca* Hoess. nelle prealpi Giulie. **[The insect fauna of *P. nigra* var. *austriaca* in the foothills of the Julian Alps.]** *Ann. Accad. Ital. Sci. For.* 8, 1959 (263–308 + 4 plates). [It.f.]

Describes the harmful insects identified (and their parasites), including *Rhyacionia buoliana*, *Thaumetopoea pityocampa*, *Cryptocephalus pini*, *Pissodes notatus*, *Magdalis phlegmatica*, 7 species of Scolytidae, *Gilpinia frutetorum* and *G. laricis*.

4619. STEFANOV, D., and ZAŠEV, B. Lesopatologični izsledvanija na njakoi tipove gora v rajona na Rosiškoto gorsko stopanstvo. **[Investigations in forest pathology in some forest types in the Rositza State Forest.]** *Nauč. Trud. Lesoteh. Inst., Sofija* No. 7, 1959 (123–33). 5 refs. [Bulg.g.]

In investigations in 7 different types of Beech forest, damage by *Cecidomyia fagi* and *Orchestes fagi* was noted in almost all; the % of leaves damaged by *O. fagi* varied between 54 and 78.

4620. TORRENT, J. A. La nueva técnica de tratamiento contra las plagas del encinar y su importancia económica. **[Modern technique for**

controlling pests of *Quercus ilex* and its economic significance.] *Montes, Madrid* 16 (91), 1959 (39–50). [Span.]

Presents a brief review of the most important pests of *Q. ilex* in Spain and a comparison of different methods of treatment, with a summary of work done by the Servicio de Plagas Forestales from 1953 to 1958 inclusive. Economic factors and secondary effects of the treatments are also discussed.

Insects: Natural and Biological Control

See also Nos. 4636, 4640–1, 4643, 4645–7, 4651, 4655–7, 4660–2, 4666–74, 4683, 4688, 4693–4702, 4705–8, 4710–2.

4621. PREBBLE, M. L. **Biological control in forest entomology**. *Repr.* from *Bulletin of the Entomological Society of America, Columbus* 6 (1), 1960 (6–8). 23 refs.

An address discussing, largely on the basis of literature in English, the chief problems of biological control, practical and fundamental research, and its chief successes and failures, mainly in the context of U.S. and Canadian forest pests.

4622. WILSON, F. **A review of the biological control of insects and weeds in Australia and Australian New Guinea**. *Tech. Commun. Commonw. Inst. Biol. Control, Ottawa* No. 1, 1960. pp. viii + 102. 558 refs.

Includes control of *Eriococcus araucariae*, a pest of *Araucaria excelsa*, by *Cryptolaemus montrouzeri*; *Chermes boemeri* on *Pinus radiata* by various introduced predators; *Myzocallis annulata* on Oaks by 4 introduced parasites; and *Asterolecanium variolosum* on Oaks by *Habrolepis dalmani*. General problems of biological control in Australia are also discussed.

4623. ALLEGRI, E. Le formiche alleate della foresta nella lotta contro gli insetti dannosi. [**Ants as an ally of the forest in the control of insect pests.**] *Monti e Boschi* 11 (4), 1960 (171–6). [It.f.e.]

In effect a review of a recent publication by M. Pavan on the use of *Formica rufa* for the control of forest pests in Italy. [Cf. *F.A.* 19 No. 2016.]

4624. PALAUS SOLER, F. J. Los picos carpinteros y su utilidad forestal. [**Woodpeckers and their usefulness in the forest.**] *Montes, Madrid* 16 (91), 1959 (13–7). 3 refs. [Span.g.f.]

Presents brief information on the most common Spanish species, i.e. *Picus viridis*, *Dendrocopus major* and *Dryocopus martius*, their habitat, nesting and feeding habits (with analyses of crop contents), and discusses their merits in the forest biocoenosis.

4625. LÖHRL, H. Zur Ernährungsbiologie des Eichelhähers. [**The food of *Garrulus glandarius*.**] *Allg. Forstzeitschr.* 15 (25), 1960 (360–7). 4 refs. [G.]

Examination of the crops and stomachs of 28 jays in an area heavily infested with *Cacoecia murinana* indicated that they destroyed large quantities of larvae and pupae of this and other pests, including *Tortrix viridana*. Though admittedly they also killed many young songbirds, on balance their encouragement is recommended.

Insects: Silvicultural Control

See Nos. 4676, 4678.

Insects: Chemical Control (General)

See Nos. 4505, 4626, 4640–1, 4645, 4652, 4657–9, 4674–5, 4677, 4680, 4682, 4688–91, 4701, 4715.

Hemiptera

See also Nos. 4622, 4684.

4626. MATUSZEWSKI, A. Zwalczanie pienika szkodnika upraw wiklinowych. [**Controlling *Aphrophora alni*—a pest in Osier beds.**] *Las Polski* 33 (10), 1959 (6–7). [Pol.]

Describes briefly the life cycle of *A. alni*, the larvae of which damage the bark of Osiers. Control is possible by dusting with BHC/DDT mixtures at 20–30 kg./ha.

4627. MEDLER, J. T., and SMITH, P. W. **Membracidae attracted to black light**. *J. econ. Ent.* 53 (1), 1960 (173–4). 5 refs.

Two black-light [infra-red] traps were placed on the ground in a garden in Wisconsin, with Oak woods in the vicinity, for 3 nights during June, during which they caught 50,000 to 70,000 tree-hoppers (mainly *Cystolobus* spp. and *Ophiderma* spp.) per night.

4628. MORAVSKAJA, A. S. Tli—vrediteli lesa. [**Aphids—forest pests.**] *Soobšč. Lab. Lesoved., Moskva* No. 1, 1959 (82–95). 34 refs. [Russ.]

Presents notes on the life history of the following aphids, and the damage they cause to Oak in the Stalingrad and Voronezh regions: *Tuberculoides annulatus*, *Phylloxera coccinea*, *Acanthochermes quercus*, *Lachnus longipes*, *L. longirostris*, *Thelaxes dryophilus*, *Tuberculatus querceus*, and *Stomaphis quercus*.

4629. ARCHIBALD, K. D. **Forest Aphidae (Aphididae) of Nova Scotia**. *Abstr. of thesis*, in *Dissert. Abstr.* 20 (8), 1960 (3435–7). 13 refs. O.R.S.

As a result of a 6 summers' study, 95 species in 33 genera have been listed. Photographs of aphids on their host plants, taxonomic keys, descriptions of the species, a host plant list, and 261 references are included in the thesis.

4630. HARPER, A. M. **Gall aphids on Poplar in Alberta. I. Descriptions of galls and distributions of aphids**. *Canad. Ent.* 91 (8), 1959 (489–96). 20 refs. O.R.S.

Presents a key for the identification of galls caused by 9 Poplar gall aphids, *Pemphigus betae*, *P. populiglobuli*, *P. populivenae*, *Thecabius populimonilis*, *P. populicaulis*, *P. populitransversus*, *P. nortonii*, *P. populiramulorum* and *Mordwilkoja vagabunda*. *Populus angustifolia* and *P. balsamifera* are primary hosts of the first 4 species listed, and *P. sargentii* is the primary host of the last 5. Galls caused by *Pemphigus betae*, *P. populiglobuli*, *P. nortonii* and *P. populicaulis* are common in Southern Alberta, and galls of *M. vagabunda*, *T. populimonilis* and *P. populitransversus* can be found on a few trees each year, whereas those of *P. populivenae* and *P. populiramulorum* are rare. *P. betae* is the only aphid studied that is of economic importance in Alberta, where it damages sugar beet. *From author's summary.*

4631. BRADLEY, G. A. **Feeding sites of aphids of the genus *Cinara* Curtis (Homoptera: Aphididae) in northwestern Ontario.** *Repr.* from *Canad. Ent.* 91 (10), 1959 (670–1).

Lists species of *Cinara*, host species, and feeding sites in early and late spring and in summer, as found on an observation area of a few square miles at Cedar Lake.

4632. BRADLEY, G. A., and WIGHTON, D. C. **Description and life history of a new species of *Cinara* (Homoptera: Aphididae) from *Pinus banksiana* Lamb.** *Canad. Ent.* 91 (7), 1959 (453–6). O.R.S.

Describes *C. piniradicis*, the only species in this genus known to feed on the roots of *Pinus banksiana*. It has been found in both Saskatchewan and Ontario.

4633. PSCHORN-WALCHER, H. Der gegenwärtige Stand der Tannenlaus-Frage in forstlicher Sicht. **[The present state of the *Adelges* problem in forestry.]** *Forstwiss. Cbl.* 79 (5/6), 1960 (129–39). 10 refs. [G.g.]

A general article with particular reference to Germany and Austria, distinguishing *A. piceae*, *A. nüsslini* and *A. merkeri*, describing their life history and habits, and discussing methods of preventing damage and of control.

4634. HARRIS, J. W. E. **The Balsam woolly aphid, *Adelges piceae* (Ratz.), in British Columbia, 1959.** *Bi-m. Progr. Rep. Div. For. Biol. Dep. Agric. Can.* 16 (2), 1960 (3–4). 1 ref.

Reports further infestations of *A. piceae* on *Abies amabilis* and also on *A. grandis* in S.W. British Columbia [cf. *F.A.* 20 No. 4849]. In sample plots on Grouse and Seymour Mountains, ⩾ 50% of *A. amabilis* was attacked. Aerial survey in the Sechelt-North Shore area showed a considerable number of dead and dying trees. In a ground check on 4 plots at Cypress Creek, an average of 32% of *A. amabilis* was attacked. The infestations are expected to spread. Successful galleries of a barkbeetle, *Pseudohyelinus* sp., were found in *A. amabilis* damaged by *A. piceae*, but not in green trees.

4635. TUNNOCK, A., and RUDINSKY, J. A. **Observations on the life-cycle of the Balsam woolly aphid, *Adelges piceae* (Ratz.) in the Willamette Valley of Oregon.** *Repr.* from *Canad. Ent.* 91 (4), 1959 (208–12). 8 refs.

4636. CLARK, R. C., and BROWN, N. R. **A field cage for rearing syrphid larvae and other predators of the Balsam woolly aphid, *Adelges piceae* (Ratz.) (Homoptera: Adelgidae).** *Repr.* from *Canad. Ent.* 91 (11), 1959 (723–5).

Describes a rearing cage of plywood and plastic that is fixed to the stems of infested trees.

4637. SCHNEIDER-ORELLI, O., and SCHNEIDER, F. Weitere Untersuchungen über *Dreyfusia*-Befall im Nordwesthimalaya. **[Further information on attack by *Dreyfusia* spp. in the northwestern Himalayas.]** *Mitteilungen der Schweizerischen Entomologischen Gesellschaft, Lausanne* 32 (2/3), 1959 (258–70). 8 refs. [G.] I.I.E.

Presents data on the morphology and biology of a new species, *D. joshii*, found on *Abies pindrow* in Uttar Pradesh, morphological notes on *D. knucheli*, and a key to *Dreyfusia* spp. based on morphological characters of the sistentes.

4638. BROWN, C. E. **Reproduction of the Pine needle scale, *Phenacaspis pinifoliae* (Fitch), (Homoptera: Diaspididae).** *Canad. Ent.* 91 (9), 1959 (529–35). 12 refs. O.R.S.

Observations on mating habits and reproduction indicate that *Phenacaspis pinifoliae* is dioecious and that unfertilized ♀s do not lay eggs, but produce abnormal scales and live longer than fertilized ♀s.

4639. BORATYNSKI, K. ***Matsucoccus pini* (Green) (Homoptera, Coccidea, Margarodidae) in Norfolk.** *Ent. mon. Mag.* 95 (1145), 1960 (240).

This insect, hitherto known from Southern England only, was found heavily infesting Scots Pine at Holkham Bay, but not on *Pinus nigra* vars. *austriaca* and *calabrica* or *P. pinaster* growing on the same coastal dunes. It was also found in the crops of tits in Suffolk.

4640. MCINTYRE, T. **Natural factors control the Pine tortoise scale in the Northeast.** *J. econ. Ent.* 53 (2), 1960 (325). 1 ref.

Toumeyella numismaticum, usually not destructive in the north-eastern U.S.A., became epidemic in 1957 in isolated Virginia Pine stands in Maryland, Pennsylvania and West Virginia. In spring 1957 a severe outbreak in Beltsville was sprayed with 1 lb. malathion in 2 gal. fuel oil per acre. Good control was obtained with the first batch of crawlers. Those emerging the week after treatment were unaffected by the spray, but later these were completely eliminated by predaceous coccinellid larvae that were under ♀ scales at the time of spraying. In an unsprayed area near by, the scale was almost eradicated by the predators by late summer.

4641. MARICONI, F. A. M., and ZAMITH, A. P. L. Notas sôbre uma cochonilha e seu predador. **[Notes on a scale insect and its predator.]** *Biológico* 25 (12), 1959 (258–65). 7 refs. [Port.e.] C.G.B.

Cassia fistula in the garden of the Instituto Educacional O Piracicabano were found to be severely infested by *Mimosicerya hempeli*. A predator, *Exoplectra erythrogaster*, was also present. Short notes are given on the biology of both insects. Experiments in control with Metasystox (methyldemeton type) by means of (1) root absorption, and (2) injection, failed. Spraying in September–November, when the nymphs are most vulnerable, would probably give best results.

Lepidoptera

See also Nos. 3992–4, 4272, 4618, 4625.

4642. MOORE, K. M. **Observations on some Australian forest insects. 5. Some additional wood-destroying larvae of Lepidoptera and Coleoptera.**

Proceedings of the Royal Zoological Society of New South Wales, Sydney 1957/58, 1959 (32–7). 13 refs.

[Cf. *F.A.* 21 No. 700.] Describes and discusses the following species, whose larvae feed in a similar manner: *Barea turbatella* (doing considerable damage to mining timber, particularly *Eucalyptus maculata*), and *Machetis aphrobola* (Oecophoridae); *Labdia deliciosella* (Cosmopterygidae), *Scieropepla* aff. *rimata* (Xyloryctidae), and *Nacerda melanura* (Oedemeridae). The last, which appears to have been established in Australia for many years, has been reported on Eucalypts, *Doryphora sassafras* and *Syncarpia laurifolia*, and also in *Pinus sylvestris* girders in the Antarctic exploration ketch, "Wyatt Earp".

4643. EIDMANN, H. Om lärkskottmalen (*Argyresthia laevigatella* H.S.) i Sverige. [***A. laevigatella* in Sweden**.] *Medd. SkogsforsknInst., Stockh.* 49 (3), 1960. pp. 22. 18 refs. [Sw.g.]

A monograph on the Larch shoot moth [cf. Beirne *F.A.* 4 p. 254], based largely on observations in Sweden, where the insect was found to be widespread on European, Japanese and hybrid Larches, discussing morphology, distribution, biology, habits, injuries, mortality factors etc. The insect appears to show some preference for younger, lower trees or the lower parts of the crown of tall trees, and to select for attack mainly shoots > 10 cm. in length and ⩾ 1·9 mm. basal diam. Movements and feeding inside the shoots were observed by X-ray photography. Injured shoots die back or break off, and heavy or prolonged attacks result in witches-broom-type malformations. Birds accounted for most of the high larval mortality (up to 95% in one heavily infested stand), parasites for < 10%. No successful control methods, chemical or biological, have yet been reported. *From author's summary.*

4644. ROMANYK, N. Nueva plaga en los pinares de Guadarrama. [**New pest in the Pine stands of Guadarrama**.] *Montes, Madrid* 16 (92), 1960 (165–6). [Span.]

A small outbreak of *Ocnerostoma piniarella*, hitherto not reported in Spain, has been discovered on the heights of Puerto del León. Brief data are given on its biology and life history.

4645. BOGAVAC, M. Platanov miner—*Lithocolletis platani* Stgr. [**The Plane leaf miner—*L. platani* Stgr.**] *Zašt. Bilja* No. 51, 1959 (51–61 + 8 photos). 7 refs. [Serb.e.*e*.] I.M.I.

L. platani is becoming a more serious pest in Jugoslavia. Details of its morphology, life history, and the damage it causes are given. Controlling factors studied include low temperatures (hibernating pupae succumb to temperatures below −10° C.) and parasites. Light infestations in 1957 were attributed to pupal parasitization in early spring by *Gnomonia veneta*, when populations were reduced by 48% vs. 7% from parasitization later in the year. Other parasites found are listed (9 Chalcidoidea, 1 Braconidae). Satisfactory chemical control was obtained with sprays of Paraphos 50 at 0·06 and 0·04%, Malatox 50 at 0·3 and 0·15%, and Diazinon 5 at 1·0 and 0·5% concentrations. The higher concentrations gave more rapid kills.

4646. TURČEK, F. J. Über den Anteil der Meisen an der Vertilgung des Tannenknospenwicklers (*Epiblema nigricana*) durch Vögel. [**The importance of tits in the destruction of *E. nigricana* by birds**.] *Waldhygiene* 3 (5/6), 1960 (145–6). 1 ref. [G.]

In Silver Fir forests in Slovakia, heavily infested by *E. nigricana* and *Cacoecia murinana*, 40–60% of several thousand buds examined in April and May had been attacked by *E. nigricana* larvae; in 13% of such buds the larvae had been eaten by tits.

4647. DROOZ, A. T. **White Pine shoot borer (*Eucosma gloriola*) Heinrich.** *J. econ. Ent.* 53 (2), 1960 (248–51). 6 refs.

E. gloriola was found on White Pine in Connecticút in 1930. It was probably also widespread at the same time in the north-eastern U.S.A. and Quebec, but confusion arose from its being misidentified as *Rhyacionia frustrana.* A study was made of damage to Scots Pine Christmas trees by *E. gloriola* over 1957–59 in Pennsylvania and observations are presented on type of damage, distribution and biology. It has also been found on other coniferous species. A larval parasite was identified as a species of *Glypta*.

4648. RENNELS, R. G. **Status of the European Pine shoot moth, *Rhyacionia buoliana* (Schiffermüller) in Illinois.** *For. Note Ill. Agric. Exp. Sta.* No. 89, 1960. pp. 3. 2 refs.

R. buoliana is rapidly increasing in importance as a potential enemy of Pine plantations in Illinois. Counties from which it has been reported are shown on a map, and a brief account of its life history and control is given.

4649. HEIKKENEN, H. J. **The identification and dating of past attacks of the European Pine shoot moth on Red Pine.** *J. For.* 58 (5), 1960 (380–4). 19 refs.

Describes a technique for dating the initial year of attack by *Rhyacionia buoliana* on *Pinus resinosa* by counting internodes or annual rings. When this date is known, the extent of population build-up and the growth rate of trees in an infested plantation can be determined. The technique also permits comparison of the growth of plantations infested for various lengths of time on different sites. Information is given on how to differentiate both past and present *R. buoliana* damage from similar injuries caused by other agents.

4650. HARRIS, P. **Production of Pine resin and its effect on survival of *Rhyacionia buoliana* (Schiff.) (Lepidoptera: Olethreutidae).** *Canad. J. Zool.* 38 (1), 1960 (121–30 + 2 photos). 12 refs. O.R.S.

The survival of *R. buoliana* larvae on *Pinus sylvestris* is related to the amount of resin encountered during the initial attack on the buds, the larvae being unable to establish themselves in very resinous buds. The resin canals in the buds are developed in response to short days at the end of summer, while the development of the moth is associated with summer temperature. Thus, more larvae survive in a warm summer than a cool one, as they attack the buds before resin protection is well developed. Fewer larvae survive on the very resinous *P. nigra* than on *P. sylvestris*, but the best survival, in stands where the 3 species grew together, was on *P. contorta*, which was also more resinous than *P. sylvestris*. Larvae are able to remove small amounts of resin oozing from their mines in the bud. It was found that a mixture of resin and larval vomitus emulsified readily, and hardened within a few hours, whereas untreated resin remained sticky for several days. The vomitus was used by the larva to prevent resin from sticking to its mouth parts; possibly the susceptibility of a Pine to attack is partly related to the ease with which the resin is emulsified. When the flow of resin became too great, larvae left their mines rapidly. It was observed that resin acted as a strong skin irritant—presumably a defence mechanism to prevent drowning. [Cf. *F.A.* 15 No. 3803.]

4651. MILLER, W. E. **Discovery in Michigan of *Orgilus obscurator* (Nees), a foreign parasite of the European Pine shoot moth.** *J. econ. Ent.* 53 (2), 1960 (318). 5 refs.

O. obscurator has been released at various times since 1928 in Ontario and the north-eastern U.S.A. It was recovered in 1957 and 1958 in Lower Michigan. The nearest release point to Michigan is Kingsville, Ontario.

4652. BEAL, R. H. **Life habits and control of Pine tip moth [*Rhyacionia frustrana*]: Results from preliminary studies.** *Sth. For. Pest Reptr. Sth. For. Exp. Sta.* No. 24, 1958. pp. 5.

After aerial spraying with DDT in fuel oil at 2·5 lb. active principle per acre at the time of adult emergence in early March in 3-year-old Loblolly Pine, the % of infested leaders fell from 84 in Feb. to 2 in May, rising again to 53 in July and 99 in Oct. Height growth by July was 1·48 ft. against 0·67 for controls. Chlordane was less effective [cf. *F.A.* 19 No. 689]. Laboratory studies on the bionomics of the insect are also reported.

4653. ELLIOTT, K. R. **A history of recent infestations of the Spruce budworm in northwestern Ontario, and an estimate of resultant timber losses.** *For. Chron.* 36 (1), 1960 (61–82 + 13 maps). 32 refs.

The build-up and course of severe infestations of the Spruce budworm in the Lac Seul and Lake Nipigon regions of N.W. Ontario are traced from recorded data between 1937 and 1955; the forest cover of the areas is described in general terms; and it is estimated that some 17 million cords of pulpwood were destroyed. The methods employed in this study allow deductions to be made which indicate that the first severe defoliation within the epicentres of the infestations probably occurred in 1939 in the Lac Seul region and in 1937 or 1938 in the Lake Nipigon region; that expansion beyond the epicentres did not occur until the mortality of Balsam Fir had commenced; and that the increase of the budworm population to the infestation level occurred abruptly. It is also shown that the relatively small and scattered representation of the primary hosts gave no protection from severe damage, and that the potential for future losses within the areas affected by 1955 is almost double the amount destroyed. *From author's abstract.*

4654. **Improving survey techniques.** *Extr.* from *Rep. Intermt. For. Range Exp. Sta. 1959*, 1960 (24).

Data from immature larval Spruce budworm populations gathered on two sample plots, were used in 1958 to compute a regression for prediction of ultimate defoliation. Usually four 15-in. twigs per tree are taken at mid-crown as a sampling unit, and a table has been developed (given in report) for field use, relating number of immature larvae per 4 twigs to % defoliation to be expected.

4655. COPPEL, H. C. **Key to adults of dipterous parasites of Spruce budworm, *Choristoneura fumiferana* (Clem.) (Lepidoptera: Tortricidae).** *Annals, Entomological Society of America, Columbus, Ohio* 53 (1), 1960 (94–7). O.R.S.

An illustrated dichotomous key to 16 commonly encountered parasites bred from *C. fumiferana* larvae and pupae from British Columbia.

4656. MCGUGAN, B. M., and BLAIS, J. R. **Spruce budworm parasite studies in northwestern Ontario.** *Repr.* from *Canad. Ent.* 91 (12), 1959 (758–83). 38 refs.

Presents the results of investigations over the years 1946–56 into the parasite complex in two areas, chosen to represent two basic types of stand, i.e. Nipigon and Lac Seul. Parasites were reared from samples of budworm collected at various stages of their development and the results are tabulated and discussed. Only a few of the parasites, of which *Meteorus trachynotus* is typical, appear to play an important rôle in Spruce-budworm control, beyond the rather constant mortality caused by the parasite complex as a whole. The extensive tree mortality occurring in both areas, however, is ample testimony to the ineffectiveness of parasites and other natural controls.

4657. **Control of Spruce spider mite and Spruce budworm.** *Extr.* from *Rep. Intermt. For. Range Exp. Sta. 1959*, 1960 (23–4).

During the summers of 1958 and 1959, a pilot test was carried out, directed at simultaneous control of the Spruce budworm and the Spruce spider mite (*Oligonychus ununguis*), by aerial spraying with the usual DDT formulation plus the miticide Genite 923 (at 0·5 or 1 lb. Genite/1 lb. DDT/gal. fuel oil). The most important results are: (1) Aerial spraying at the rate of 1 gal./acre of the above formulations did not effectively control *O. ununguis* populations in infested Douglas Fir forests. (2) Use of either of the Genite/DDT formulations or of DDT alone apparently reduces the populations of mites predaceous on *O. ununguis*. (3) The delicate balance between *O. ununguis* and predaceous mite populations that exists under natural conditions is disturbed by spraying, and at least 2 years is required for this predator-prey relation to return to normal.

4658. STOLINA, M. Premnoženie obal'ovača jedl'ového (*Choristoneura murinana* Hb.) na strednom Slovensku vo vzťahu ku skupinám lesných typov. [**Outbreaks of *Cacoecia murinana* in Central Slovakia in relation to forest-type groups.**] *Lesn. Čas.* 6 (2), 1960 (99–113). 33 refs. [Slovak. russ.g.]

From studies on two outbreaks in the last 20 years, it is concluded that the outbreaks started in the Silver Fir forests of the *Fageto-Quercetum* and *Querceto-Fagetum*, and that the Fir forests of the *Abieto-Fagetum* were the most resistant. Optimum climatic conditions for the outbreaks occur in areas with a mean annual temperature of 7–9° C., and a mean annual precipitation of 600–900 mm. Best reaction to attack (viz. needle and shoot regrowth) was observed in Firs 65–75 years old in the *Fagetum pauper* in the first 4 years of the outbreak, but after this, new needle and shoot growth declined. Accordingly, in areas where the environment is relatively unfavourable for Fir, chemical control should be started not later than the 4th year of the outbreak.

4659. SILVER, G. T. **A new black-headed budworm infestation in the Queen Charlotte Islands, British Columbia.** *Bi-m. Progr. Rep. Div. For. Biol. Dep. Agric. Can.* 16 (2), 1960 (3).

The population of *Peronea variana* has built up rapidly to a high level since collapse in 1955 and 2 years at a very low level. Some areas have not recovered from previous defoliation, and egg counts indicate a twofold increase in larval populations in 1960 over 1959. Areas of high hazard (ca. 30,000 acres) may be sprayed in June 1960.

4660. SCHÜTTE, F. Vogelschutz und Eichenwickler—zur Problematik. [**Bird protection and *Tortrix viridana*—associated problems.**] *Anz. Schädlingsk.* 33 (3), 1960 (33–41). 17 refs. [G.]

Presents the results of observations made in 9 forests in 4 different forest districts of W. Germany, comparing damage by *Tortrix viridana* in stands with high and low bird population densities. The density of bird populations, although important, is a factor completely outweighed by the density of the insect population. There is only a narrow density range within which birds are liable to exert any marked effect, i.e. when the insect population is such that it causes ca. 50% defoliation. Under the conditions studied, it seems that it is not possible to control an outbreak by increasing the bird populations of a stand, but it remains an open question whether raising the bird populations could prevent an outbreak and whether it could control one in which insect populations had previously been reduced by chemical means. [Cf. *F.A.* 19 No. 664.]

4661. OSSOWSKI, L. L. J. Erfahrungen mit Polyeder-Viren gegen den Akaziensackwurm, *Kotochalia junodi* (Heil)—Psychidae. [**Control of *Acanthopsyche junodi* by polyhedral virus.**] *Repr.* from *Transactions, 1st International Conference on Insect Pathology and Biological Control, Praha* 1958 (247–52). 14 refs. [G.russ.]

Describes experiments in South Africa [cf. *F.A.* 19 Nos. 3213–4] and, briefly, field tests (not yet evaluated) in which 300 ha. of *Acacia decurrens* var. *mollissima* were sprayed from the air, using lower concentrations, to avoid a complete kill, so as to ensure transmission of infection to the progeny of the pest.

4662. OSSOWSKI, L. L. J. **Variation in virulence of a Wattle bagworm virus.** *Repr.* from *Journal of Insect Pathology, New York* 2 (1), 1960 (35–43). 12 refs.

To obtain further information about the occurrence and virulence of a nuclear polyhedral virus of the Wattle bagworm, *Kotochalia* [*Acanthopsyche*] *junodi*, small-scale experiments were conducted using virus suspensions prepared from different sources, including one from Uganda from the cotton bollworm *Heliothis armigera.* With a light infestation in the first year of the prodromal stage, and the larvae newly hatched or in their second or third instar at time of spraying, viruses brought from plantations 160–200 miles from the experimental areas caused a significantly higher mortality throughout than did any others. Viruses from plantations 20–40 miles distant gave an initially greater kill than local virus or that from the thornveld, while the bollworm virus, though giving a higher kill than on untreated plots up to 3 months after spraying, proved less effective than any bagworm virus. With a heavy infestation in the second year of the prodromal stage and the larvae in the first instar, mortality with the bagworm virus from the greatest distance was significantly higher only initially. Later there was no significant difference between bagworm virus treatments, all proving more effective than bollworm virus. These results suggests that different strains of the bagworm virus exist and that a given bagworm population differs in its susceptibility to these strains. [Cf. *F.A.* 19 No. 3214.] *From author's summary.*

4663. WELLINGTON, W. G. **Qualitative changes in natural populations during changes in abundance.** *Canad. J. Zool.* 38 (2), 1960 (289–314). 8 refs. O.R.S.

An extension of earlier studies on *Malacosoma pluviale* [cf. *F.A.* 21 No. 3463]. Between 1956 and 1959, fourth-instar colonies along 156 miles of road in the outbreak area in southern Vancouver Island decreased from 74,000 to 251. The % of active colonies fell from nearly 100 to 45–55% as years of residence in the locality increased from 1 to 4, and then rose again. Data from egg-mass samples, adult activity indices based on wing-scale loss and wing-tearing (description given) and from caterpillar behaviour, also indicated declining vitality as the population aged, followed by sudden recovery at or near minimum abundance, when its least viable portion had been eliminated.

4664. GALE, MAUNG. **Pest on Mango.** *Burmese For.* 9 (1), 1959 (28 + 3 photos). 3 refs.

A note on *Cricula trifenestrata*, a saturniid defoliator of Mango and some other species in Rangoon.

4665. MIJIN, K. Prvi prilog poznavanju faune Ceruridae (Notodontidae) i Tetheidae (Cymatophoridae) Srbije. [**A first contribution to the study**

of the fauna of the Ceruridae and Tetheidae of Serbia.] *Zašt. Bilja* No. 46, 1958 (107–13). 10 refs. [Serb.serb.f.] I.M.I.

Lists, with data on life history, host plants and distribution, 3 spp. of Tetheidae and 21 of Ceruridae (of which 13 are new records for Serbia). The commonest potential cerurid pests as defoliators of trees are: *Dicranura vinula*, *Pygaera anastomosis*, *P. nigra*, *P. curtula* and *Phalera bucephala*.

4666. BOGAVAC, M. Autohtoni paraziti dudovca i njihova uloga u dinamici populacije ove štetočine. **[Indigenous parasites of *Hyphantria cunea* and their role in the population dynamics of this pest.]** *Zašt. Bilja* No. 46, 1958 (75–81). 8 refs. [Serb.e.*e*.] I.M.I.

Parasites of (*a*) the first and (*b*) the second generation of *H. cunea* were studied for 3 and 4 years respectively at Buljkes (Vojvodina, Serbia). The mean % of parasitized pupae for these periods was 19·5 for (*a*) vs. 5·5 for (*b*). It was concluded that the effect of parasites on the population dynamics of *H. cunea* is unimportant. These figures were compared with those for (*a*) in 1954 in 7 other districts in Vojvodina, where parasitization was found to vary from 13·92 to 46·21%. The % of parasitized pupae attacked by tachinids, ichneumons, or chalcids is shown, and each parasite family is discussed. The commonest parasites were *Compsilura concinnata*, *Pimpla examinator*, and *Psychophagus omnivorus*. *P. examinator* was observed to attack not only pupae but also caterpillars of *H. cunea*. It attacks only (*a*). A tachinid, *Carcellia bombylans*, was recorded for the first time as a parasite of *H. cunea* caterpillars. [Cf. *F.A.* 17 No. 4183.]

4667. THOMSON, H. M., and SMIRNOFF, W. **A note on an unidentified microsporidian associated with *Aletia oxygala luteopallens* (Sm.) (Lepidoptera: Noctuidae).** *Canad. J. Zool.* 38 (2), 1960 (438–9). 1 ref. O.R.S.

When larvae of *A. luteopallens* found dead and dying near Quebec were examined, a polyhedral virus and a protozoon were discovered in the midgut epithelia. The life cycle of the protozoon (*Plistiphora* sp.) is described.

4668. ESLYN, W. E. ***Hemerocampa pseudotsugata* McDunnough, a new host for *Beauveria bassiana* (Balsamo) Vuillemin.** *Repr.* from *Journal of Insect Pathology, New York* 1 (4), 1959 (434–5).

A fungus identified as *B. bassiana* was found in the body cavities of mummified pupae. The possibility of its use in biological control is briefly discussed.

4669. STEFANOV, D. Vărhu njakoi biotični faktori, ograničavašči masovoto rasprostranenie na găbotvorkata (*Lymantria dispar* L.) v našite gori. **[Some biotic factors limiting mass distribution of *L. dispar* in Bulgarian forests.]** *Nauč. Trud. Lesoteh. Inst., Sofija* No. 7, 1959 (7–17). [Bulg.]

Discusses, in fairly general terms, the effect of tree foliage (i.e. food), predators, and disease, on *L. dispar* populations.

4670. MOZETIČ, M. Osamitev virusa poliedrije iz gosenic gobarja (*Lymantria dispar*) v Sloveniji. **[Isolating the polyhedral virus from larvae of *L. dispar* in Slovenia.]** *Gozd. Vestn.* 18 (5), 1960 (129–32). 3 refs. [Sloven.g.]

Describes the method of isolating *Borrelina reprimens* from dead larvae.

4671. TEMPLADO, J. Datos sobre *Ooencyrtus kuwanai* How. (calcídido parásito de *Lymantria dispar* L.) en España. **[Data on *O. kuwanai*, chalcid parasite of *L. dispar* in Spain.]** *Publicaciones del Instituto de Biología Aplicada, Barcelona* 25, 1957 (119–29). 17 refs. [Span.span.e.] L.S.

O. kuwanai was introduced into Spain from the U.S.A. during 1923–29. In 1955 studies were made in the Oak stands of El Pardo on the status of the parasite. Parasitization of *L. dispar* was ca. 20–25%. Competition with the native *Anastatus disparis* seems to be negligible. Some morphological and biological data on both species are presented. Further dissemination of *O. kuwanai* seems to be desirable.

4672. BLOCK, B. C. **Laboratory method for screening compounds as attractants to gypsy moth [*Lymantria dispar*] males.** *J. econ. Ent.* 55 (1), 1960 (172–3). 1 ref.

4673. DOWNES, J. A. **The gypsy moth and some possibilities of the control of insects by genetical means.** *Canad. Ent.* 91 (10), 1959 (661–4). 6 refs. O.R.S.

Discusses the possibility of large-scale control by crossing a "strong" race with a "weak" race, and thus producing sterile ♀s.

4674. PETERSEN, B. B. Angreb af penselspinderen på Ulborg skovdistrikt. **[Attack by *Orgyia antiqua* in the Ulborg forest district.]** *Dansk Skovforen. Tidsskr.* 45 (2), 1960 (94–100). 2 refs. [Dan.e.]

A mixed stand, planted in 1946 and thinned for the first time in 1957–58, was seriously defoliated by larvae of *O. antiqua* in July 1959. *Picea abies* and *Larix leptolepis* were almost completely, *Abies alba* less, and *Picea glauca*, *A. nobilis*, *Pinus mugo*, *Prunus serotina* and *Cytisus scoparius* only slightly, defoliated. Aerial dusting with 30 kg. DDT/ha. gave good control at a cost of Kr. 60/ha. A considerable number of eggs remained on the trees, but many were parasitized by *Aholcus* (*Telenomus*) *dalmanni*. *O. antiqua* appeared to have completed two generations in 1959.

Coleoptera

See also Nos. 3995–9, 4082–3, 4583, 4618–9, 4642, 5049–50.

4675. THOMPSON, G. H. **Native farms and coleopterous timber pests in Ghana.** *Emp. For. Rev.* 39 (2), 1960 (220–5). 4 refs.

A study during forest clearance for a 4-acre food farm in the moist semi-deciduous high forest of Ghana, showed a rapid build-up of beetle populations on dead and dying trees. Of 93 bark and wood-boring species identified (listed with tree hosts), 51 may attack the 7 major local timber species. Insecticidal treatment of logs may be necessary where farming is taking place near log dumps or sawmills: for this purpose γ-BHC is recommended.

4676. EATON, C. B. **Insect-caused mortality in relation to methods of cutting in Ponderosa Pine on the Blacks Mountain Experimental Forest.** *Tech. Pap. Pacif. Sthwest. For. Range Exp. Sta.* No. 43, 1959. pp. 33. 11 refs.

Mortality was measured annually for 16 years after cutting on replicated 20-acre plots established in old-growth *Pinus ponderosa* stands to test the effects of 5 methods of cutting (clear felling and 4 types of selective felling, including removal of high-risk trees only). Of the total Pine sawtimber volume that died, insects (chiefly *Dendroctonus brevicomis* on *P. ponderosa* and *D. jeffreyi* on *P. jeffreyi*, aided by *Melanophila californica*, attacking both hosts, and *Ips* spp.) accounted for ca. 70%. On control plots, beetles killed a mean annual volume of 73·6 bd. ft./acre, or 0·441% of the stand, vs. 0·2–19·3 bd. ft./acre, or 0·036–0·132% on treated areas. Clear cutting gave a reduction of 93% in volume of timber killed in 15 years, and other treatments ca. 70% in 16 years. The findings indicate that this reduction depends more on removing susceptible trees before the beetles attack them than on the particular method used. Projections of the data suggest that once susceptible trees are removed, mortality from insect damage may not return to pre-cutting levels for > 50 years.

4677. BELLIS, E. de. Efficacia immediata e residuale di tre insetticidi clororganici sulla *Plagiodera versicolor* Laich. [**Immediate and residual efficacy of three chlorinated hydrocarbon insecticides against *P. versicolor*.**] *Pubbl. Cent. Sper. Agric. For., Roma* No. 3, 1959 (1960), (61–76 + 2 plates, 1 tbl.). [It.it.e.*e*.]

Heptachlor, lindane, and dieldrin were tested for their residual efficacy against this defoliator. Heptachlor was found to have little insecticidal value at any of the concentrations tested (40, 60, 80 and 100 g./100 litres water). Lindane and dieldrin killed all larvae in 2 hours, but their action lasted no longer than that of Pb arsenate at 0·4–0·6%, which therefore remains the most suitable insecticide for the control of *P. versicolor*.

4678. EWAN, H. G. **The Poplar borer in relation to Aspen stocking.** *Tech. Note Lake St. For. Exp. Sta.* No. 580, 1960. pp. 2. 1 ref.

Of 145 $\frac{1}{10}$-acre Aspen plots in the northern Lake States, 42 showed no *Saperda calcarata* damage, 77 had 1–10% of stems infested, and 26, 11–65%. When the plots were grouped by d.b.h. class, it was found that the larger the mean d.b.h., the greater the infestation. Though plots with mean d.b.h. > 7 in. were too few to determine whether this trend would change, the rough, thickened bark of larger stems is thought to be less suitable for oviposition. Grouping by number of stems per plot showed that as the number increased beyond 40, the infestations decreased. It was concluded that intermediate cuts of any kind probably increase borer damage, and that well stocked stands should be maintained until clear-felling at maturity.

4679. SASAKAWA, M., and WAKITA, K. [**A note on the damages by the Pine weevils.**] *Sci. Rep. Kyoto Prefect. Univ.* (*Agric.*) No. 11, 1959 (71–4). 2 refs. [Jap.jap.e.]

Presents comparative results of variance analyses of the damage caused by (i) *Hylobius abietis haroldi*, (ii) *Sipalus hipocrita*, and (iii) *Monochamus tesserula* on *Pinus densiflora* logs set as traps in 1957. The most severe attack was observed for (i) adults when the trap logs were laid out among broadleaved trees or Bamboos. Oviposition was greater for (ii) on the thicker, and for (iii) on the thinner, bark of *P. densiflora*.

4680. BUTOVITSCH, V. Vårens planteringar och snytbaggsfaran. [**Spring planting and *Hylobius abietis*.**] *Skogen* 47 (7), 1960 (148–9). [Sw.]

Discusses some methods of control (dipping the plants in DDT, or using as traps fresh Spruce bark or blocks of Pine wood soaked in DDT or in a thiophosphoric preparation), with some detail of costs.

4681. FINNEGAN, R. J. **The pales weevil, *Hylobius pales* (Hbst.), in southern Ontario.** *Repr.* from *Canad. Ent.* 91 (10), 1959 (664–70). 16 refs.

Notes on hosts, seasonal history and habits of *H. pales*, which in recent years has built up to epidemic proportions in Christmas-tree plantations in S. Ontario.

4682. THATCHER, R. C. **Toxicity of BHC to Loblolly Pine seedlings.** *J. econ. Ent.* 55 (1), 1960 (175–6). 3 refs.

Seedlings totally dipped in 1% or 2% BHC before planting, as a protection against *Pachylobius picivorus* [cf. *F.A.* 20 No. 3487] had significantly lower height growth than controls, and some of those totally dipped in 2% concentrations died. It is recommended that BHC be employed only as a top dip on Loblolly Pine. A 1% or 2% concentration gives a high degree of weevil control, but care must be taken to prevent root contamination.

4683. BREZNER, J. I. **Biology, ecology and taxonomy of insects infesting acorns. II. The use of serum proteins as an indication of species specificity in larval *Curculio* (Coleoptera, Curculionidae).** *Abstr. of thesis*, in *Dissert. Abstr.* 20 (9), 1960 (3896). O.R.S.

(I) During 1956–57, 73,264 acorns from 17 Oak species were collected from all areas of Missouri. *Curculio* spp. were responsible for most primary infestations. Degree of parasitization found was low; one hymenopterous and two dipterous parasites were reared. Predators include birds, shrews and moles. Seven *Curculio* spp. were reared, two specific to the annual and two to the biennial Oaks, one non-specific and the others inadequately represented. In a study of larval taxonomy, no separation could be made on the basis of external morphology. Acorn infestation rates for annual Oaks were 23 and 35% and for biennial Oaks 25 and 14% in 1956 and 1957 respectively. The difference between the two years may perhaps be explained as resulting from host specificity, as 1957 yielded very poor mast for White and good mast for Black Oaks.

(II) A study of 60 larval blood samples suggested that, in *Curculio*, blood proteins are specific to species, but as no *Curculio* sp. can as yet be identified in the larval stage, no direct comparison of species and protein patterns could be made.

4684. SCHWERDTFEGER, F. Fichtenborkenkäfer und Buchenwollaus im Gefolge der Dürre 1959. **[Spruce barkbeetles and *Cryptococcus fagi* as a result of the 1959 drought.]** *Forst- u. Holzw.* 15 (8), 1960 (151–2). [G.]

Discusses the increase in both Lower Saxony and North Rhine-Westphalia.

4685. BRAUN, J. H. Histogene und gummöse Abwehrreaktion nach Borkenkäfer-Infektion bei *Tsuga heterophylla* (Raf.) Sarg. **[The reaction of *Tsuga heterophylla* against barkbeetles by cell proliferation and resinosis.]** *Allg. Forst- u. Jagdztg.* 131 (5), 1960 (116–8). [G.g.e.]

Describes and illustrates the reaction observed in 9- to 11-year-old trees attacked by [unspecified] barkbeetles. In an area of radius 4–5 cm. round each point of attack, a layer of parenchyma, 12–15 cells thick, was formed, containing a great many vertical resin ducts and resulting in a copious resin flow that filled the larval galleries and so repelled the intruder. Normal cambial activity was soon resumed. As no similar reaction was observed on mechanical wounds, a reaction to some toxin secreted by the beetles is suggested [cf. *F.A.* 18 No. 674].

4686. CHARARAS, C. Recherches sur la biologie de *Pityokteines curvidens* Germ. et étude de son comportement à l'égard des substances extraites des oléorésines. **[The biology of *P. curvidens* and its behaviour with oleoresin extractives.]** *Annales de l'Institut National Agronomique, Alençon* 44, 1958 (83–131). 13 refs. [F.f.] C.G.B.

Presents the results of an intensive study in Haute-Savoie, particularly in the forest of Seythenex. Species composition of the stand is an important factor, since pure stands offer ideal conditions for the development of the pest. In mixed stands of *Abies alba* and *Picea abies*, only the former is attacked. Extractives of the oleoresins (α-pinene, β-pinene, terpinol etc.), repellent at high concentrations, are attractive when very dilute (0·1–0·5%). Their attractiveness was considerably diminished in the presence of fresh specimens of *A. alba*. The number of insects attracted varied according to their stage of development. Attempts to induce infestations of *Thuja occidentalis*, *Juniperus communis* and *Cupressus sempervirens* failed completely; this is thought to be due to the presence in all three of camphene, which is repellent to *P. curvidens*. Observations are also presented on life history and biology of the insect and the influence of climate on its development. Temperature is an important factor. Spread of *P. curvidens* is favoured by storms, hot dry summers, and the extension of pure stands.

4687. CHARARAS, C. L'influence des conditions climatiques sur l'évolution des scolytides. Compte rendu de plusieurs années d'éxperimentation dans les forêts de Haute-Savoie. **[The influence of climatic conditions on scolytid development. Report on several years' research in the forests of the Haute Savoie.]** *Ann. Éc. Eaux For. Nancy* 16 (2), 1959 (135–67). 19 refs. [F.f.e.g.]

One of the most striking of the author's findings is the importance of illumination in stimulating swarming; e.g. direct sunlight will provoke swarming of *Ips typographus* at only 14° C., though this species normally requires a minimum of 18° before taking flight. Scolytids may be divided into two groups, early- and late-swarming respectively, according to the minimum temperature necessary, e.g. *Blastophagus piniperda* 9° and *Ips typographus* 16–18°. In every case, however, they are very sensitive to changes in the microclimate, which thus plays an important part in determining the flight periods of each species. Laboratory experiments on the effect of low and high temperatures led to the recognition of different zones of activity lying between the lower lethal threshold (death from cold) and the upper limit where the insects are killed by excessive heat.

4688. WEI, H.-C. **[Preliminary investigation of barkbeetle foci, and methods of destroying them.]** *For. Sci., Peking* 1960 (1), (63–9). 9 refs. [Chin. chin.]

A study, 1956–58, of a severe infestation of *Blastophagus piniperda* and *B. minor* in young stands of mixed *Pinus densiflora* and *P. tabulaeformis* in Liaoning (Manchuria). All stands had been filled in, and the worst infested was 14 years old. Spraying with 40% DDT, 6% γ BHC and E.605 [parathion], or smoking with IIIA666 [BHC] gave best results from March to June, the time of egg-laying, but results were poor owing to the thick bark of these Pines. Both beetles were attacked by a predator provisionally identified as *Thanasimus formicarius*.

4689. JACKSON, W. L. **A trial of direct control of Pine engraver beetles on a small logging unit.** *Misc. Pap. Pacif. Sthwest. For. Range Exp. Sta.* No. 44, 1960. pp. 7. 4 refs.

An account of an apparently successful trial on 39 acres at Challenge Experimental Forest, California, in 1959. Lindane with kerosene was applied by backpack spray to fresh logging slash heavily infested with these beetles. The total cost was $273.40. Though outbreaks followed logging on other sites, only one pole-sized tree was killed in the treated area.

4690. MASSEY, C. L. **DDT—a preventive control for the southwestern Pine beetle.** *Res. Note Rocky Mt. For. Range Exp. Sta.* No. 40, 1960. pp. 1. 1 ref.

In a *Dendroctonus barberi* outbreak area in New Mexico, a 2% emulsion of DDT was applied twice, in May and July, to 745 *Pinus ponderosa* trees. The entire surface of each stem was sprayed to a height of 40 ft. with a power sprayer. Examination in

September, when beetle flight had ceased, showed that only 3 treated trees were infested, whereas 103 out of 286 interspersed controls had been killed.

4691. MILLER, J. M., and KEEN, F. P. **Biology and control of the western Pine beetle [*Dendroctonus brevicomis*]. A summary of the first fifty years of research.** *Misc. Publ. U.S. Dep. Agric.* No. 800, 1960. pp. vii + 381. 497 refs.

Reviews results of research up to July 1, 1952, including much unpublished material from the files of the Division for Forest Insect Research. The text, intended primarily for research and field workers concerned with surveys, appraisal, and control, is presented in 5 main sections: Biology, seasonal history and habits; Biotic relationships; Relations between beetles and host trees; Western Pine beetle surveys; and Control methods and strategy.

4692. KNIGHT, F. B. **Measurement of Engelmann Spruce beetle [*Dendroctonus engelmanni*] populations.** *Ecology* 41 (2), 1960 (249–52). 7 refs.

Basic information on the number of Engelmann Spruce beetles that attack a Spruce tree, and the number of ensuing progeny in the stem, has been developed. The theoretical number of beetles successfully attacking a 20-in. Spruce is ca. 1500. The number attacking a 10-in. tree is ca. 500. These numbers, compared with population data, indicate that too few beetles are produced in the basal 5 ft. of the stem to reinfest a tree of the same diameter. Beetles must be produced and survive in fairly large numbers above the 5-ft. level to maintain an infestation. Counts of population samples recorded when the beetles were in the adult stage shortly before emergence for hibernation fitted the negative binomial distribution. This information should be useful in developing a sequential sampling system for measuring barkbeetle populations. *From author's summary.*

4693. JAMNICKÝ, J. Kôrovec *Dendroctonus micans* Kug., škodca smrekov (*Picea excelsa* Link.) tatranských parkoch. **[The barkbeetle *D. micans* as a pest of *P. abies* in the Tatra parks.]** *Sborn. Prác. Tatr. Nár. Parku, Tatr. Lomnica* No. 3, 1959 (156–63). 3 refs. [Slovak.russ.e.g.]

In one area 6·3% of the trees were attacked; in other areas $\not>$ 2%. The Ichneumonidae *Ephialtes terebrans* and *Ischnurgops claviger* were parasites of the larval stage.

4694. **Douglas Fir beetle.** *Extr.* from *Rep. Intermt. For. Range Exp. Sta. 1959*, 1960 (17–9).

Average density and total length of *Dendroctonus pseudotsugae* egg galleries were found to be consistently less in fallen trees than in standing trees, but % of brood survival was greater. Many parents in egg galleries in Utah were found to be parasitized by *Tomicobia tibialis*—its first recorded insect parasite. Two clerids, *Enoclerus sphegeus* and *Thanasimus undatulus*, are important predators of *D. pseudotsugae*.

4695. KHAN, M. A. **Descriptions of two nematodes, *Ektaphelenchus macrostylus* n. sp., and *Laimaphelenchus ulmi* n. sp., with a key to species of *Laimaphelenchus*.** *Canad. J. Zool.* 38 (1), 1960 (91–7). 7 refs. O.R.S.

Two new species of nematodes from Canada are described: *E. macrostylus* sp. nov.—♀s were collected from the Douglas-Fir beetle *Dendroctonus pseudotsugae*, and ♂s from the beetle galleries in the bark of *Pseudotsuga taxifolia*; and *L. ulmi* sp. nov., collected from bark of *Ulmus americana*. A key is given to the species of *Laimaphelenchus*.

4696. MASSEY, C. L. **Nematode parasites and associates [collected from egg and larval galleries] of the California five-spined engraver, *Ips confusus* (Lec.).** *Repr.* from *Proceedings of the Helminthological Society of Washington* 27 (1), 1960 (14–22). 8 refs.

4697. PARAMONOV, S. J. **A review of Australian Pyrgotidae (Diptera).** *Aust. J. Zool.* 6 (1), 1958 (89–137). 11 refs. O.R.S.

The review includes 7 new genera and 37 new species. Observations indicate that pyrgotids are parasitic on adult beetles of the family Scarabaeidae, and are an important factor in regulating the number of the beetles, which are defoliators of Eucalypts.

Hymenoptera

See also No. 4618.

4698. VASIĆ, K., and PETROVIĆ, M. Kvalitativna analiza uloge parazitskih insekata, i entomofagnih gljivica u redukciji prenamnoženih populacija obične borove zolje (*Diprion pini* L.), na Malenju 1954 i 1955 godine. **[Qualitative analysis of the role of parasitic insects and entomophagous fungi in reducing *D. pini* populations on Mt. Maljen in 1954–55.]** *Zašt. Bilja* No. 43, 1957 (3–28). 12 refs. [Serb.e.*e*.] I.M.I.

[Cf. *F.A.* 17 No. 3078.] *Achrysocharella ruforum* was again the most important parasite, followed by *Exenterus marginatorius*. Three species of fungi were also found to reduce *D. pini* numbers, especially during the winter.

4699. MIJIN, K. Konkurentski odnosi između *Dahlbominus fuscipennis* Zett. i *Habrocytus* sp., kao parazita *Diprion pini* L. **[Competitive relations between *D. fuscipennis* and *Habrocytus* sp. as parasites of *D. pini*.]** *Zašt. Bilja* No. 51, 1959 (39–45). 5 refs. [Serb.serb.e.*e*.] I.M.I.

Specimens of *D. fuscipennis* and *Habrocytus* sp. were reared from cocoons of *Diprion pini* and *Neodiprion sertifer*, and the life history of *Habrocytus* sp., was studied. The life cycle was 16–18 days, ♀ fertility averaging 47·8 eggs laid in 2 batches. When eggs of *Habrocytus* sp. and *D. fuscipennis* were placed on artificially paralysed eonymphs of *D. pini*, the number of imagos of each species was strikingly reduced compared with controls, as a result of competition. When roughly equal numbers of eggs were transplanted, *D. fuscipennis* became the predominant species. It was found in experiments on natural oviposition that ♀s of either species can distinguish cocoons already attacked by the other, and will rarely lay in them. [Cf. *F.A.* 21 No. 3419.]

4700. **Biological sawfly controls sought by entomologists**. *Extr.* from *Rep. Wis. Agric. Exp. Sta. 1958*, 1959 (1–2).

The presence of a caged ♀ Pine sawfly [*Neodiprion* sp.] on a board covered with tanglefoot, often attracted > 700 ♂s. The attraction seems to disappear 3–6 days after the ♀ dies. The attractant is apparently contained in the abdomen.

4701. DASKALOVA, I. Izsledvanija vărhu răzdivata borova listna osa (*Diprion sertifer* Geoffr.) u nas. **[Investigations on *D. sertifer* in Bulgaria.]** *Nauč. Trud. Lesoteh. Inst., Sofija* No. 7, 1959 (137–45). 7 refs. [Bulg.g.]

Discusses distribution, morphology, biology damage, parasites (10 species, mainly chalcids), and chemical control (April application of DDT and BHC is best).

4702. TRIPP, H. A. **Observations on the hyperparasite, *Euceros frigidus* Cress.** *Bi-m. Progr. Rep. Div. For. Biol. Dep. Agric. Can.* 16 (2), 1960 (2). 2 refs.

Describes the life history of *E. frigidus*, which lays its eggs near the eggs of *Neodiprion swainei* on *Pinus banksiana*. Its planidia attach themselves to *N. swainei* larvae, and complete their life cycle, after the sawfly larvae have been parasitized by *Olesicampe lophiri*, by entering the larvae of the primary parasite. Other recorded hosts of *E. frigidus* are *Lamachus* sp. and *Endasys subclavatus*.

4703. **Sawflies pose new threat to Wisconsin's pulp industry**. *Extr.* from *Rep. Wis. Agric. Exp. Sta. 1958*, 1959 (6).

Neodiprion virginianus, a species new to Wisconsin, is attacking Jack Pine plantations. Preliminary studies show that it overwinters as mature larvae in cocoons in the needle litter. Emergence of adults begins ca. mid-May. Oviposition is in the previous year's needles. Study of the factors that favour a second generation indicates that they occur under conditions of high humidity and a large number of successive days above 50° F. [Cf. *F.A.* 21 No. 2137.]

4704. **A new Pine sawfly**. *Sth. For. Pest Reptr. Sth. For. Exp. Sta.* No. 22, 1958 (5).

Describes a sawfly collected in Arkansas and Louisiana, defoliating Shortleaf Pine, but not associated Loblolly Pine, in autumn and winter. It has been classified as a member of the *Neodiprion virginianus* complex, possibly a new species. Larvae closely resemble those of *N. exitans*.

4705. DROOZ, A. T. **The Larch sawfly, its biology and control**. *Tech. Bull. U.S. Dep. Agric.* No. 1212, 1960. pp. iii + 52. 118 refs. Price 25 cents.

A monograph on *Pristiphora erichsonii* based on world literature, incorporating a report on field and laboratory studies on *Larix laricina* in N. Minnesota in the years 1952–56. Though, in any one year, oviposition usually began at the same time on a dry and on a wet plot, larval emergence and development were faster on the dry site. It proved impossible to predict defoliation from pupal densities. Defoliation rate depended *inter alia* on the amount of water on the soil surface at the time of larval drop or adult emergence, and also on past defoliation in so far as this affected the development of new shoots on which eggs could be laid. Increment for the 2 years 1953 and 1954 was much less than that of the pre-outbreak years 1947–48, while that of Black Spruce on the same sites was slightly greater. Mortality on the bog sites of N. Minnesota was first observed after the 7th or 8th year of noticeable defoliation. Preliminary tests with nematodes as a means of biological control are briefly described. While, in the laboratory, infective stages of larvae of Steinernematidae killed the sawfly larvae of all 5 instars within 48 hours (presumably through a bacterial disease carried by the nematodes), few nematode-infected larvae were recovered after field tests in which trees, or the sphagnum below them, had been sprayed at the time of the larval drop with aqueous suspensions.

4706. IVES, W. G. H., and PRENTICE, R. M. **Estimation of parasitism of Larch sawfly cocoons by *Bessa harveyi* Tnsd. in survey collections.** *Canad. Ent.* 91 (8), 1959 (496–500). 2 refs. O.R.S.

Describes a technique whereby cocoons are obtained from moss-filled trays, 4 ft. square, placed under tree crowns. The trays should be scattered throughout each plot, because of intra-plot variability in parasitization. Twenty trays per plot will provide satisfactory estimates of parasitization by *B. harveyi*. Confidence limits for the proportion parasitized should be estimated by a quadratic approximation. *From authors' summary.*

4707. MACLEOD, C. F. **The introduction of the masked shrew [*Sorex cinereus cinereus*] into Newfoundland**. *Bi-m. Progr. Rep. Div. For. Biol. Dep. Agric. Can.* 16 (2), 1960 (1). 2 refs.

[Cf. *F.A.* 21 No. 3508.] A fuller account of the introduction of this predator of *Pristiphora erichsonii.*

4708. SMIRNOFF, W. A., and BÉIQUE, R. **On a polyhedral disease of *Trichiocampus viminalis* (Fall.) larvae (Hymenoptera: Tenthredinidae)**. *Canad. Ent.* 91 (6), 1959 (379–81). O.R.S.

Mortality of *T. viminalis* in Quebec City in July 1957 was found to be due to a virus disease. Symptoms and results of successful infection tests are briefly described.

4709. CHALLEN, S. B. **Phytochemical changes initiated by insects. Part 1. Preliminary work on leaves and 'bean galls' of *Salix fragilis* L.** *Pharmaceutical Journal, London* 183 (5006), 1959 (213–4). O.R.S.

Results of chromatographic analysis of leaves, galls, and leaves from galls suggest that one phytochemical change initiated by the sawfly [*Pontania proxima*?] is an accumulation of catechins, leucoanthocyanins, and a ninhydrin-positive substance.

4710. HUSSEY, N. W. **Two new species of *Mesopolobus* Westwood (Hym. Pteromalidae) with notes on other parasites of *Megastigmus* Dalman (Hym. Torymidae)**. *Ent. mon. Mag.* 95 (1145), 1960 (237–9). 7 refs.

Describes *Mesopolobus spermotrophus* sp. nov.

bred from seeds of Douglas Fir (from Ross-shire) infested with *Megastigmus spermotrophus*, and *Mesopolobus pinus* sp. nov. bred from seeds of *Abies procera* (from Aberdeenshire) infested with *Megastigmus pinus*, and discusses the parasites of *M. amelanchieris*, *M. brevicaudis*, *M. pistaciae*, etc. [Cf. *F.A.* 19 No. 2090.]

Diptera

See also No. 4619.

4711. Postner, M. Die biologische Bekämpfung der Tannennadelgallmücke *Agevillea abietis* Hubault (Cecid., Dipt.) mit Hilfe der Schlupfwespe *Platygaster manto* Walk., (Platyg. Proctotr.). **[Biological control of *A. abietis* with *P. manto*.]** *Forstwiss. Cbl.* 79 (5/6), 1960 (158–61). 9 refs. [G.g.]

[Cf. *F.A.* 21 No. 3510.] Cleanings from a small stand known to have a high level of natural parasitization of *A. abietis* by *P. manto*, were distributed on an experimental area where *A. abietis* had caused serious damage to young Silver Fir. Parasitization of *A. abietis* reached 86%, and this inexpensive method of biological control is thought to be economically feasible on small areas, especially where chemical control has to be avoided.

4712. Templado, J. Observaciones biológicas sobre *Dryomyia lichtensteini* (F. Löw), cecidómido productor de agallas en las hojas de la encina. **[Biology of *D. lichtensteini*, a cecidomyiid causing leaf galls on *Quercus ilex*.]** *Boletín de la Real Sociedad Española de Historia Natural, Madrid* (*Sección biológica*) 55 (1), 1957 (145–55). 14 refs. [Span.span.e.] L.S.

A study of the life history and habits of *D. lichtensteini*, based on observations in the Oak forests of El Pardo, Madrid, with notes on 3 parasites found there, i.e. *Platygaster dryomiae* (new for the Spanish fauna), *Eutelus mediterraneus* and *E. lichtensteini*.

4713. Hedlin, A. F. **Description and habits of a new species of *Phytophaga* (Diptera: Cecidomyiidae) from Western Red Cedar cones.** *Repr.* from *Canad. Ent.* 91 (11), 1959 (719–23). 4 refs.

Describes and illustrates *P. thujae*, with notes on life history and habits.

4714. **Causes or gummosis in Black Cherry.** *Extr.* from *Rep. Ntheast. For. Exp. Sta. 1959*, 1960 (18–9).

Gum spot or gummosis, a defect found in the wood of *Prunus serotina*, was found to be caused primarily by the cambium miner, *Phytobia pruni*. The larval channels under the bark cause gum streaks or spots in the wood; they usually begin in the small branches, lead down to the stem, and then lead either up or down.

4715. Duda, E. J. **Leaf miner control with Sevin.** *Sci. Tree Topics* 2 (7), 1960 (8–9).

Satisfactory control of the Birch leaf-miner (*Fenusa pusilla*) and the Holly leaf-miner (*Phytomyza ilicis*) was obtained by spraying with Sevin (1-naphthyl-*N*-methyl carbamate) at 2 lb. 50% wettable powder in 100 gal. water.

459. Other Animals

See also No. 4551.

4716. Rühm, W. Nematoden und Forstpflanzen. I. Mitteilung. Zur Bodenentseuchung in Forstbaumschulen und Forstkamps. **[Nematodes and forest plants. I. Soil disinfestation in forest nurseries.]** *Repr.* from *Merck-Blätter, Darmstadt* 9 (3), 1959 (1–16). 21 refs. [G.]

Discusses the role of nematodes as a factor in the complex phenomenon of "soil sickness" in nurseries, with special reference to conifers. A list of parasitic nematodes identified on conifers in Germany, the U.S.A. and the Netherlands is given. In the conifer nurseries investigated, usually $\not>$ 20% of all nematode species present were parasitic, but the numerical density of parasitic species was often very great, *Rotylenchus robustus* being one of the most abundant. *Picea sitchensis* appeared to be a highly susceptible species. Sampling techniques and general problems of control by nematocides (e.g. phytotoxicity and injury to soil fungi and mycorrhizae) are discussed. In small-scale trials, DD, Mylone, chloropicrin, MeBr, Vapam, and an unnamed "Bayer" preparation, gave good results which appeared to be fairly lasting on light, well drained, well cultivated loamy sands, but no final evaluation or recommendation can yet be made.

4717. Hamilton, C. C. **New developments in miticides for shade trees.** *Proc. 34th Nat. Shade Tree Conf. 1958*, 1959 (23–33).

Discusses in some detail three groups of compounds: (1) Kelthane, Dimite and chlorobenzilate, which are relatively poor ovicides but are effective against adults, nymphs, and young hatching from the eggs; (2) Ovotran, Mitox, Fenson and Genite 923 (chlorinated benzenes), differing from (1) in having fairly good ovicidal properties; (3) Malathion, Guthion, Trithion, and Ethion (with a P group in their structure).

4718. **Spider mites.** *Sth. For. Pest Reptr. Sth. For. Exp. Sta.* No. 26, 1959 (4).

A severe outbreak of *Oligonychus milleri* in May 1959 on 10 million acres of Shortleaf and Loblolly Pine in Arkansas and N. Louisiana caused extensive loss and browning of needles, particularly in young, open-grown, under-stocked stands. Shortleaf suffered more than Loblolly. Dry weather and fungus diseases may have favoured the outbreak. Heavy rains in late May and in June caused most of the mites to disappear and led to abundant new growth.

46. Damage by Man

See Nos. 3989, 4234–5, 4470, 4566.

48. Injuries Due to Unknown or Complex Causes

See also No. 4230.

4719. **The fungus flora associated with bark necrosis on the main stems of [Sitka] Spruce.** *Extr.* from *Rep. Imp. For. Inst., Oxf. 1958/59*, 1959 (14).

Trials have been made by attempted isolations to see whether there is any consistent association of a particular fungus with the local extension of necrotic areas. The indications are that a mixture of mycelia is involved. The fungus most commonly associated with this necrosis is *Nectria cucurbitula*, but wound inoculations using perithecia of this fungus did not indicate that it was a primary pathogen.

4720. DAY, W. R. **Diseases of the crown in Black Pine, *Pinus nigra* Arnold. 1. Die-back and debility of the crown in Pines in Cyprus, with special reference to *P. nigra* Arnold, subsp. *pallasiana* Lamb.** *Emp. For. Rev.* 39 (2), 1960 (172–84).

Investigations in the Troodos Mountains showed that crown dieback and debility of *P. nigra* (and to a lesser extent *P. brutia*) were associated with open stands, water-losing sites, and stony, eroded soils (profiles given). Necrosis of the phloem of affected trees, often resulting in death of the cambium and of any branch or shoot so girdled, appeared to arise from physiological stress. No crown infection was detected, though root infections may possibly reduce the efficiency of root action. It was concluded that the condition is caused by water shortage, partly aggravated by nutrient deficiencies. Case histories for 17 affected trees are given.

4721. MOLNAR, A. C., and MCMINN, R. G. **The origin of basal scars in the British Columbia Interior White Pine type**. *For. Chron.* 36 (1), 1960 (50, 52–60). 14 refs.

Basal scarring, a conspicuous abnormality of *Pinus monticola* and its associated species in the Interior region of British Columbia, was found to be chiefly attributable to injury by bears, infections of *Armillaria mellea*, fire, mechanical wounding, and the pole-blight disease. Diagnostic characteristics, which facilitated classification of scars even of advanced age, were found and described. The implications of the various types of scarring are considered. *From authors' abstract*.

4722. ROTH, E. R. **Plots demonstrate 16 years' loss from littleleaf**. *J. For.* 58 (4), 1960 (322–3). 6 refs.

A further report on plots established in 1940–41 to follow the progress of the disease [cf. *F.A.* 10 No. 2991; 16 No. 735]. Figures are based only on dominant and co-dominant Shortleaf Pines undisturbed throughout the study. On the 9 plots that were essentially healthy in 1941, 25% of trees were dead from littleleaf in 1957, and a further 24% diseased. On plots moderately diseased in 1941, 29% of trees were dead in 1957 and 46% diseased, and on heavily diseased plots, 62% were dead in 1957 and 24% diseased. In 1941, of the total of 990 trees with a mean age of 37, 15% were diseased. In 1957, 37% were dead and an additional 33% diseased. To counteract this rapid deterioration in littleleaf areas, constant surveillance and short rotations are recommended.

4723. LINZON, S. N. **The development of foliar symptoms and the possible cause and origin of White Pine needle blight**. *Repr.* from *Canad. J. Bot.* 38 (2), 1960 (153–61). 24 refs.

Needle blight of *Pinus strobus* is characterized by an orange-red discoloration of the distal portions of current-year needles. At Chalk River, Ontario, 600 seedlings and saplings of White Pine were examined repeatedly throughout the 1957 and 1958 growing seasons for the appearance and development of needle-blight symptoms. The first of these were faint pinkish spots on the stomata-bearing faces of needles in semi-mature (about four-week-old) tissue. These developed rapidly into orange-red bands which within a few days spread to the needle tips. Mature tissue was not susceptible to attack, so lesions which developed subsequently were always proximal, on younger tissues derived from basal meristems. Attacks which occurred in the early summer killed only limited areas at the tips of needles, whereas those that occurred when the needles were nearly full grown involved most of their length. Needle-blight incidence was confined to a few major outbreaks during one season and, in each of these, many trees developed typical symptoms at essentially the same time. Each outbreak occurred after 1 or more days of wet weather followed suddenly by a continuous sunny period. No micro-organisms were isolated from tissues displaying the initial needle-blight symptoms. It appears from data on the nature and occurrence of needle blight that susceptibility to the unfavourable conditions which incite it is inherent in the individual, and that differences in response among members of a local population depend on variations in susceptibility, rather than on a varying local predisposition among uniformly susceptible individuals. The blight is initiated in semi-mature leaf tissues only, but then spreads distally throughout adjacent, more mature tissues with a similar pattern of breakdown. *From author's summary*.

5. FOREST MENSURATION. INCREMENT; DEVELOPMENT AND STRUCTURE OF STANDS. SURVEYING AND MAPPING

52. Measurements of Stem Dimensions and Volume of Trees, Stands, Forests and Timber

4724. Het meten van hout. **[Timber measurement.]** *Ned. Bosb. Tijdschr.* 32 (4), 1960 (103–35). [Du.]

Presents draft proposals by a specially appointed commission for: (1) felled timber in the rough, (*a*) classes (by proposed use, quality and dimensions), (*b*) measurement of length and diameter and calculation of volume of "heavy" and "light" timber (mid-diam. ⩾ 20 cm. and < 20 cm. respectively), and stacked wood; (2) standing timber, (*a*) classes (for hardwoods by proposed use and d.b.h.; for conifers by quality and d.b.h.), (*b*) volume determination. Sample blank forms are given.

4725. CH'ÊNG, T.-S. **[A mensuration instrument.]** *For. Sci., Peking* 1960 (1), (55–62). [Chin. russ.]

Describes and illustrates the instrument (designed by the author) and its use. It determines tree height, diameters in the upper part of the tree, horizontal distances, etc. and can easily be converted into Bitterlich's angle-count instrument for measuring total b.a., stand density, etc.

4726. HELLRIGL, B. Una nuova teoria dendrometrica: la relascopia. **[A new theory of tree measurement: the use of the relascope.]** *Ital. for. mont.* 15 (1), 1960 (8–28). 32 refs. [It.it.f.]

A general review of the theory and practice of the use of the relascope for measuring basal area, number of trees/ha., dimensions of mean tree, form factors, and stand volume, with descriptions of the various modifications and improvements to the instrument.

521. Diameter (Girth) and Sectional Area

See also Nos. 4725–6, 4745.

4727. BONES, J. T. **Estimating d.b.h. from stump diameter in the Pacific Northwest.** *Res. Note Pacif. Nthwest. For. Range Exp. Sta.* No. 186, 1960. pp. 2.

The ratio of d.b.h. to stump diameter inside bark, with standard error of estimates, is presented for 7 softwood species. The number, mean diameter, and diameter range of trees sampled for computation is shown.

4728. SPADA, B. **Estimating past diameters of several species in the Ponderosa Pine subregion of Oregon and Washington.** *Res. Note Pacif. Nthwest. For. Range Exp. Sta.* No. 181, 1960. pp. 4. 2 refs.

Presents formulae for calculating past o.b. diameters of *Pseudotsuga taxifolia*, *Pinus ponderosa*, *P. contorta*, *Abies concolor*, *A. lasiocarpa*, *Picea engelmannii*, and *Larix occidentalis*. These are based on the relationship between bark thickness and d.o.b. at breast height, which was established from large samples and appears to be linear for diameters > 5 in. [Cf. *F.A.* 17 No. 4267; 20 No. 2132.]

4729. KUUSELA, K. Vaihtoehtoisia menetelmiä relaskoopilla rajoitetun puuston kuutioimiseksi. **[Alternative methods for calculating the volume of growing stock delineated by relascope.]** *Metsät. Aikak.* 1960 (2), (41–4, 51). 4 refs. [Fi.e.*e*.]

Describes the use of the relascope, in combination with further measurements of the counted trees, for the determination of crop volumes.

4730. STÖHR, K. F. **A suggestion for achieving greater accuracy in sample plot surveys according to the goniometric sampling method.** Translation Service, Department of Internal Affairs, Wellington, New Zealand. 1959. pp. 12. Transl. from *Allg. Forst- u. Jagdztg.* 130 (1), 1959 (23–9). Limited distribution. [See *F.A.* 20 No. 3540.]

522. Height, Length

See No. 4725.

523. Bark

See No. 4728.

524. Determination of the Volume of Trees and Stands

See also Nos. 4724, 4726, 4729.

524.1. Principles of Volume Determination. Form (Taper)

See also No. 4741.

4731. GROCHOWSKI, J. Pełność a zbieżystość strzały drzewa. **[Stem form and taper.]** *Folia for. polon.* (*Leśn.*) No. 1, 1958 (9–44). 15 refs. [Pol. russ.g.]

A largely theoretical exposition of the distinctions and relationships between (*a*) form expressed in relation to cylinder volume, (*b*) taper expressed as diameter decrease per unit length, and (*c*) geometrical shape, with brief reference to the importance of these distinctions for forest mensuration and utilization.

4732. DUHOVNIKOV, JU. Novi pokazateli na stăblenata pălnodărvesnost i văzmožnosti za tjahnoto opredeljane vărhu stojašti dărveta. **[New indicators of stem taper and possibilities of determining them on standing trees.]** *Nauč. Trud. Lesoteh. Inst., Sofija* No. 6, 1958 (49–87). 8 refs. [Bulg.g.]

It is argued that indicators of the degree of cylindricity used hitherto (true form quotients and true form factors) are inadequate. It is therefore considered necessary to derive more useful diameter-quotient series based on the "normal" diameter (i.e. the mean of 10 diameters measured at decimal fractions of total stem height), and also simple methods of expressing the taper of standing trees. For this the author proposes the use of a "natural form factor", by which he understands the ratio of the volume of any particular tree to that of an ideal tree having the same height and "normal" diameter, as defined above, but representing the mean taper for a given species, as determined by measurements on a number of sample trees. For this study, 372 sample trees of *Pinus sylvestris* from 41 sample plots were used. The calculated series of "natural form factors" approximate graphically to straight lines; coefficients expressing the angular deviations of these lines from the mean are proposed as the new index of taper. In testing this method, straight-line relationships of stem taper and diameter emerged for all the sample plots. The accuracy of determining stem taper by using classes of diameter quotients is discussed, and it is shown that ocular estimation by this method is correct to ± 8·6%.

4733. DUHOVNIKOV, JU. Otnositelni (razredni) pokazateli na stroeža na dărvostoite i văzmožnosti za izpolzuvaneto im pri săstavjane na obemni i sbegovi tablici i provеždane analiz na dărvostoja. **[Relative (class) indicators of stand structure, and possibilities of using them in the preparation of volume and taper tables and in carrying out stand analyses.]** *Nauč. Trud. Lesoteh. Inst., Sofija* No. 7, 1959 (69–87). 2 refs. [Bulg.g.]

[Cf. preceding abstract.] Working on Scots Pine, the author proposes new indicators of stand structure, viz. (1) thickness coefficients—the coefficients of the straight lines resulting from plotting d.b.h./height against d.b.h.; and (2) taper coefficients—the coefficients of the straight lines resulting from plotting form factor against d.b.h. The relations of (1) and (2) with age and tree spacing are shown in tables and graphs. The values of (1) depend on tree spacing, and so can be used as indicators of it. The tree spacing is, in turn, connected with stem taper. These relationships indicate that stem taper can be determined from stem diameter and the stand height class. The straight-line relationships mentioned above make it possible to determine growing conditions in the past by means of stem analysis.

4734. Iliev, A., and Peev, P. Naturalni pokazateli za stăblenata pălnodărvesnost na smărča. **[Natural indices for stem taper of Spruce.]** *Nauč. Trud. Lesoteh. Inst., Sofija* No. 7, 1959 (91–109). 3 refs. [Bulg.g.]

Using 505 sample trees, the authors calculate the normal natural form factors for Spruce [cf. preceding abstracts]. Comparison of the taper of Pine and that of Spruce shows that there are no species differences up to the age of 60, but that differences in form do develop later.

4735. Stoehr, H. A. **Engineer scale used as dendrometer.** *J. For.* 58 (4), 1960 (320). 1 ref.

Describes a method of determining the Girard form class of standing trees by means of an engineer's scale attached at right angles to a bamboo pole. Readings can be taken from the ground with low-powered binoculars. Formulae for conversion are given.

524.3. Volume of Tree Groups and Stands

See also Nos. 4748, 4792–3.

4736. Gedney, D. R., and Johnson, F. A. **Weighting factors for computing the relation between tree volume and d.b.h. in the Pacific Northwest.** *Res. Note Pacif. Nthwest. For. Range Exp. Sta.* No. 174, 1959. pp. 5. 1 ref.

Weighting factors were computed for both board-foot and cubic-foot volume and are listed for d.b.h.'s from 5 to 100 in.; they appear to be fairly constant regardless of species or location in Oregon and Washington.

4737. Seth, S. K., and Dabral, S. N. **General volume tables for *Abies pindrow* Spach.** *Indian For. Rec.* (*n.s.*) *Silviculture* 10 (4), 1957 (1959), (103–14). Price: *Rs.* 1.75 (2*s.* 6*d.*).

4738. Eggli, W. Funktionen und Tabellen zur Kubierung von stehenden Bäumen. Weisstanne (*Abies alba* Miller syn. *Abies pectinata* Lam. et C.C.). **[Volume tables and equations for standing trees. *A. alba*.]** *Rapp. Avd. Skogsprod. Skogsforsknlnst., Stockh.* No. 3, 1960. pp. 27. 8 refs. [G.sw.*sw.*]

Presents regression equations for form factors and volume (o.b. and u.b.) with tables for volume o.b. and u.b., based on 1507 stems aged 20–100 years from thinnings in S. Swedish trial plots of imported provenances, ranging from 4 to 57 cm. in d.b.h. and 2 to 32 m. in height.

4739. Rieger, R. Badania dokładności tabel miąższości jodły Grundnera-Schwappacha. **[Testing the accuracy of the Grundner-Schwappach volume tables for Silver Fir.]** *Sylwan* 104 (1), 1960 (21–40). 7 refs. [Pol.russ.e.]

[Cf. *F.A.* 19 No. 3271; 20 No. 2143.] Measurements were made on 728 trees from two sample areas in stands averaging 99 and 107 years, 80% of the trees being within the range 81–120 years. The mean % error of the tables was +0·25% of the true volume in one stand and −0·12% in the other. They gave good results for stands where the form quotient $q_2 = 0{\cdot}745$; the values obtained from the tables were too high for $q_2 < 0{\cdot}745$, and too low for $q_2 > 0{\cdot}745$.

4740. Schmitt, R., and Schneider, B. Die Aufstellung von Massentafeln nach der Methode der kleinsten Quadrate. **[The construction of volume tables by the method of least squares.]** *Mitt. Hess. Landesforstverw.* No. 2, 1959. pp. 56. 21 refs. [G.]

Presents volume tables for Spruce for the Vordere Vogelberg region (Hesse), based on 2178 stems in 70 stands, and describes and discusses the mathematical-statistical method employed (based on Schumacher and Hall's logarithmic formulae). Though somewhat laborious, even with modern computer aids, it requires fewer sample data than do graphical methods to achieve a desired accuracy, besides giving well defined fiduciary limits.

4741. Butėnas, J. Lietuvos TSR miškų eglės stiebo forma ir tūrio bei nulaibėjimo lentelės. **[Stem form of Spruce in Lithuania, and the construction of volume and taper tables.]** *Liet. Miškų Ūkio Moksl. Tyr. Inst. Darb.* No. 3, 1958 (39–137). 33 refs. [Lith.russ.]

A detailed statistical study, based on measurements of 5444 stems. Volume and taper tables were constructed for three stem form classes.

4742. Heiskanen, V., and Tiihonen, P. Rinnankorkeusläpimittaan perustuvat sahapuiden kuutioimistaulukot. **[Volume tables for sawtimber stems based on breast-height diameter.]** *Commun. Inst. For. Fenn.* 49 (5), 1958 (1959). pp. 76. 44 refs. [Fi.e.*e.*]

A commentary on volume tables for *Pinus sylvestris* and *Picea abies* issued in 1956 by Tapio and based on (1) d.b.h. and number of logs per stem and (2) d.b.h. and utilized length. The accuracy of the tables and the methods and data used in their preparation are discussed in detail.

4743. Gülen, I. Karaçam (*P. nigra*, Arnold) hacim tablosu. **[Volume tables for *Pinus nigra* [var. *caramanica*].]** *Istanbul Üniv. Orm. Fak. Derg.* 9*A* (1), 1959 (97–113). 14 refs. [Turk.g.*g.*]

Double-entry tables (7–100 cm. d.b.h. by 1-cm. gradations and 6–40 m. height by 1-m. gradations) based on measurements of 6295 stems.

524.6. General Surveys of Forests and Whole Tracts of Forest. Partial Enumeration Surveys, Timber Cruising

See also Nos. 4729–30, 4798, 5195.

4744. Holt, W. W., and Nelson, R. E. **A timber resource survey for Hawaii.** *For. Surv. Release Pacif. Sthwest. For. Range Exp. Sta.* No. 38, 1959. pp. 12.

Outlines the methods being used in this survey, started in late 1957 on the islands of Hawaii and Oahu and to be completed in 1963. Aerial photographs supply preliminary information; sample plots are located from these and examined on the ground, particular attention being paid to the now valuable plantations of exotics introduced primarily to protect catchment areas.

4745. Sudia, T. W. **Frequency calculations from several different forest ecological sampling methods.** *Ohio J. Sci.* 60 (2), 1960 (100–5). 11 refs. C.G.B.

[Cf. *F.A.* 21 No. 3542.] Three sampling methods —(1) the quadrat, (2) the point-centred quarter method, and (3) the plotless-variable-radius method —were compared in order to demonstrate that species frequencies as estimated by all three methods can be compared, so long as species frequency (the probability of finding the species of interest in a given subsample), species density (number of stems of the species of interest per unit area), and relative species density (the probability of encountering the species of interest when sampling the stems one at a time) are reduced to common terms. Analysis of variance for each method showed no significant differences between them.

4746. Kangas, Y. Koealan muoto ja koko koeala-arvioinnissa. **[The influence of plot shape and size on sample plot survey.]** *Metsät. Aikak.* 1959 (12), (419–20); 1960 (1; 2), (17–20, 22; 54–5). 2 refs. [Fi.e.]

Reports on a study of the quantity of timber left in the forest after logging operations in state forests. As well as conventional circular sample plots, plots in the shape of a longish rectangle on 20-m. sections of the survey line were used. Advantages of the latter include: rapid and reliable delineation of the plot; easier supervision of the work; and a possible reduction in scatter of statistical material. Pilot measurements were made to determine the most suitable sample plot; from these, data from plots of different sizes could be grouped and the deviation for changes of plot size calculated. Results are tabulated. A graph is given showing the expenditure of survey work for various plot sizes. The plot size giving the best work performance decreases with increasing survey %s, and small sample plots are most favourable as regards work expenditure; the larger number of plots also makes it possible to obtain a more representative sample. Some general points are also discussed. *From author's summary.*

525. Volume by Assortments. Merchantable Volume

4747. Kalnin, A. **[Changes in the assortment structure of Scots Pine stands in relation to age.]** *Latvijas PSR Zinātņu Akadēmijas Vēstis, Riga* 1959 (7), (157–63). [Russ.?] From *abstr.* in *Holzforschung, Berlin* 14 (2), 1960 (59). [G.] P.R.

For various forest types, site classes II–IV, and age classes III–VII in Latvia.

4748. Minore, D., and Gedney, D. R. **Merchantable height of trees in Oregon—a comparison of current logging practice and volume table specifications.** *Res. Note Pacif. Nthwest. For. Range Exp. Sta.* No. 184, 1960. pp. 5. 2 refs.

Concludes, from statistically analysed measurements of 252 trees in E. Oregon and 95 in W. Oregon, both before and after cross-cutting, that the standard cruising practice of calculating the minimum merchantable top diameter as 40% of d.b.h. when using Bruce and Girard's volume tables leads to highly significant inaccuracies.

526. Log Measurement. Scaling

4749. Iliev, A., and Kolev, N. Tablici za kubirane na trupi po diametăra na tănkija kraj. **[Tables giving log volume from the diameter of the thin end.]** *Nauč. Trud. Lesoteh. Inst., Sofija* No. 7, 1959 (113–9). 5 refs. [Bulg.g.]

The basal, mid and top diameters of 392 Silver Fir logs (half 4 m. long, half 5 m.) were measured, and log volume determined by a standard formula. Graphs and volume tables were then drawn up, showing, for both log lengths, the log volume against top diameter, separately for butt logs and other logs. The accuracy of the tables is compared with that of Bulgarian tables based on mid-diameter measurements, and Soviet tables based on top-diameter measurements, and is held to be sufficient.

4750. Aro, P., and Nisula, P. Kuusi- ja mäntypaperipuurankojen kuutio- ja mittaustaulukoita. **[Volume tables and tally sheets for Spruce and Pine "long" pulpwood.]** *Commun. Inst. For. Fenn.* 49 (7), 1958 (1959). pp. 98. 47 refs. [Fi.g.*g*.]

Separate tables and simplified tally sheets are presented for three floating areas, based on top diam. u.b. and total length. Those for S. Finland are in metric (5–25 cm., 2–6 m.) and those for N. Finland in English units (2½–9 in., 7–23 ft.).

4751. Miraboğlu, M. Ortayüzey formülünün sıhhatı ve devlet orman işletmelerimizdeki tatbikatı. **[The accuracy of the mid-section formula, and a proposal to improve Turkish wood mensuration.]** *Istanbul Üniv. Orm. Fak. Derg.* 9*A* (1), 1959 (31–47). 7 refs. [Turk.g.]

Discusses the accuracy of Huber's formula, on the basis of measurements of 10 Fir, 3 Pine and 3 Black Pine stems deliberately chosen for their great variation in taper. The formula gave a negative error with very tapering stems, and a positive one on nearly cylindrical stems. From these findings, the following practical rule is proposed for use in Turkish state forests: use Huber's formula for all logs ≯ 4 m. long; divide all longer logs into section ≯ 4 m., and measure the volume of each section individually.

527. Solid Volume of Stacked Products (including Converting Factors)

4752. NYLINDER, P. Fastmasseprocent hos några klenvirkessortiment. **[Solid volume of some small wood assortments.]** *Uppsats. Instn. Virkeslära K. Skogshögsk., Stockh.* No. *R*21, 1959. pp. 12. 37 refs. [Sw.]

Presents tabulated results showing volume, solid volume %, weight, moisture, oven-dry density, etc., from measurements on 95 cu. m. of 2-m. sulphate pulpwood, 680 cu. m. of 2-m. and 195 cu. m. of 3-m. board wood, 269 cu. m. of 2-m. wood from slabs and edgings and 673 cu. m. of chips from sawmill waste. Compares the results obtained with those from other studies, mainly Scandinavian and N. American.

4753. T., S. Nytt instrument för virkesmätning. **[A new instrument for timber measurement.]** *Skogsägaren* 36 (4), 1960 (110–1). [Sw.]

Describes, with illustrations, a small rotating cylinder with toothed rims designed by I. Lindström, which is rolled over the face of the stack. There are feelers, spaced at 8 cm., at right angles to the stack surface; when these stick out into a space between log ends, a point is registered on a recording device; where they touch a log end, no point is registered. The proportion of air space in the stack surface can be calculated from the points registered by the feelers, the total number of points being registered by a separate recording device. The instrument is designed for use on stacks of pulpwood of standard length. Individual log ends sticking out ≯ 5 cm. from the general stack surface will not affect the measurements. For a normal stack, measurements along two horizontal and three vertical traverses are recommended, but the number of these will vary with size of stack.

53. Special Measurements of Trees and Stands (Crown Dimensions, Stand Density etc.)

See also Nos. 4733, 4745, 4767, 4772–4, 4791, 4795.

4754. STRICKLER, G. S. **Use of the densiometer to estimate density of forest canopy on permanent sample plots**. *Res. Note Pacif. Nthwest. For. Range Exp. Sta.* No. 180, 1959. pp. 5. 1 ref.

Describes a modified technique for accurate permanent-plot work. The densiometer is fitted with a compass and mounted on a tripod, which is centred over a point permanently marked in the plot. Instead of taking 4 readings at different points in the plot and using all 96 dots in the densiometer grid, the observer takes one reading in each cardinal direction from the fixed location, relative canopy closure being estimated from 17 points in a wedge-shaped area of the grid. Overlap and duplication of observations are thus avoided, while tests showed that the time required to take readings for a cluster of plots was halved. [Cf. *F.A.* 18 No. 3184.]

4755. WYATT-SMITH, J. **Stems per acre and topography**. *Malay. Forester* 23 (1), 1960 (57–8).

It is a frequent field observation in hilly country in Malaya that there appears in general to be: (1) a greater number of trees per acre growing on the ridge-tops than on the hill slopes and valley bottoms, and (2) a higher proportion of economic species on the ridges and slopes than in the valleys. A standard enumeration in which the topography of each chain square was noted and the presence of any stream indicated, was carried out at 1200 to 1850 ft. alt. in a compartment of Bukit Lagong Forest Reserve, Selangor. Analysis of the results appears to confirm the above field observations, with the additional information that the number of trees in (*a*) chain squares immediately adjoining the ridge tops (*b*) is even less than that on the true hillside (*c*) (numbers per acre (*a*) 32, (*b*) 57·8, (*c*) 45·4). This decline is almost entirely due to a great reduction in the number of trees in the 3- to 6-ft. girth classes. The proportion of economic species to total number of individuals was lowest in the valley bottoms.

54. Assessment of Site Quality

See also Nos. 3946, 4141, 4230, 4766.

4756. WECK, J. Les classes de formation forestière de la terre et leur production potentielle de substance. **[The chief forest types of the world and their growth potential.]** *Repr.* from *Scientia, Asso* (*Ser. 6*) 54, 1960 (1–3). [F.f.]

Briefly discusses Paterson's CVP index and its limitations, and the production of total dry matter, wood substance, harvestable and harvested wood in tropical and temperate forests. It is estimated that ca. 8% of the dry matter produced is harvested in temperate, and 0·5% in tropical forests. [Cf. *F.A.* 21 No. 860.]

4757. DOOLITTLE, W. T., and VIMMERSTEDT, J. P. **Site index curves for natural stands of White Pine [*Pinus strobus*] in the Southern Appalachians.** *Res. Note Stheast. For. Exp. Sta.* No. 141, 1960. pp. 2.

The curves, based on 105 plots in pure and mixed Pine/hardwood stands, are to replace those issued in 1934 as *Technical Note, Appalachian Forest Experiment Station* No. 5. Plots ranged from a mean 22 to a mean 78 years. Mean height at 50 was 83 feet. [Cf. *F.A.* 21 No. 831.]

4758. STONE, E. L., *et al.* **Soil and species adaptation: Red Pine plantations in New York.** *Proceedings, First North American Forest Soils Conference, East Lansing 1958*, [1959?] (181–4). 12 refs.

Discusses, largely on the basis of published data, the inadequacy of growth rate—especially early growth rate—as a basis of site evaluation, stressing the need to take into account hazards such as diseases, drought susceptibility and later growth checks, which can often be inferred from physical or chemical soil characteristics. In Red Pine, checked growth is largely connected with poor or excessive drainage. Moreover, since mortality caused by such hazards tends to eliminate the weaker trees, it may actually raise the site index on certain unsuitable sites.

4759. ECK, W. A. VAN, and WHITESIDE, E. P. **Soil classification as a tool in predicting forest growth.** *Proceedings, First North American Forest*

Soils Conference, East Lansing 1958, [1959?] (218–26). 28 refs.

A study based on 120 plots in *Pinus resinosa* plantations in Michigan on 35 different soil series, indicating that the soil characters commonly recognized in soil classification and mapping (texture, drainage, genetic type etc.) are associated with major changes in site quality and form an adequate framework for its prediction. Site indexes ranged from 36 to 74 and, for each age group, higher site indexes corresponded to higher b.a., d.b.h., volume, and m.a.i.

4760. COX, G. S., MCCONNELL, R. C., and MATTHEW, L. M. **Ponderosa Pine productivity in relation to soil and landform in Western Montana.** *Proc. Soil Sci. Soc. Amer.* 24 (2), 1960 (139–42). 13 refs.

Data were obtained on 255 plots in medium- to well-stocked stands on 28 soil series and 9 landform types (e.g. mountain slope, glacial moraine). Mean site indices ranged from 54 to 99 ft. at 100 years. Effective depth of soil in which tree roots could develop was the main factor influencing growth. Four factors limited root development: depth to gravel or loose sand; depth to a slowly permeable layer; depth to bedrock; and depth to lime. Areas receiving supplementary moisture from seepage or high water-tables were good sites, regardless of the soil type. *From authors' summary.*

4761. STOECKELER, J. H. **Soil factors affecting the growth of Quaking Aspen forests in the Lake States.** *Tech. Bull. Minn. Agric. Exp. Sta.* No. 233, 1960. pp. 43. 108 refs. [Cf. *F.A.* 18 No. 1973.]

4762. BROADFOOT, W. M., and KRINARD, R. M. **Guide for evaluating Sweetgum sites.** *Occ. Pap. Sth. For. Exp. Sta.* No. 176, 1959. pp. 8 + 1 map.

Presents three practical methods of estimating the ability of mid-south soils to grow *Liquidambar styraciflua*, based on (1) the clay and K content of the soil at 36–48 in. depth; (2) the texture, internal drainage, and presence or absence of hardpan in the top 2 ft. of soil (applicable only in the Mississippi River flood-plain); (3) soil series and phase.

55. Age Determination

4763. PANDE, D. C. **On a method for determining age of trees without annual rings.** *Indian For.* 86 (3), 1960 (117–31). 3 refs.

The method described is based on the theory that the growth of trees is the result of two opposing factors—one impelling growth at a constant rate and the other opposing this growth, the opposing factor being proportional at all times to the square of the d.b.h. A general formula is derived, which gives fairly acceptable estimates (actual examples tabulated) over a wide range of diameters.

56. Increment. Development and Structure of Stands

See also Nos. 4126, 4161, 4168–9, 4223, 4230, 4257 *et seq.*, 4375, 4378–9, 4388 *et seq.*, 4763.

4764. GALLAGHER, G. **An assessor's observations on Irish conifer crops.** *Irish For.* 17 (1), 1960 (21–6).

Notes on increment and yield of plantations, as observed during the work of assessment [for taxation purposes?].

4765. ZIMMERMANN, E. Über das Wachstum der Hauptholzarten in den Hochlagen des Württembergischen Schwarzwalds. **[The growth of the main species in the high-lying parts of the Schwarzwald in Württemberg.]** *Allg. Forst- u. Jagdztg.* 131 (3), 1960 (59–64). 15 refs. [G.e.]

Discusses height, diameter, form etc. on the basis of 135 stem analyses of trees up to 280 years old, mainly Spruce, but also Scots Pine and Silver Fir [cf. *F.A.* 19 No. 22 for site description]. On the poorer, because drier, S. slopes, m.a.i. had not always culminated in stands aged 175 years. Volume growth of individual trees was greatest in Fir, least in Spruce, but Spruce stands showed a greater m.a.i./ha. than the less dense Pine, which, however, suffered less from disease (red rot in Spruce, canker in Fir). Silvicultural and management problems are discussed.

4766. GRIFFITH, B. G. **Growth of Douglas Fir at the University of British Columbia research forest as related to climate and soil.** *For. Bull. Fac. For. Univ. B.C.* No. 2, 1960. pp. 58. 9 refs.

The basic information for this study was obtained from 8 plots situated in nearly pure stands of young Douglas, of site index 80 to 180. Data are presented on (1) the climate of the area for the period 1946–57, (2) physical characteristics of the soils of the 8 plots, (3) soil-moisture records for the periods June–Sept. during 1952–56, (4) annual radial and b.a. growth during 1953–57 for 68 dominant and co-dominant trees growing on the 8 plots, and (5) a statistical analysis of the various factors affecting b.a. growth. Site quality appears to have no effect on the initiation of radial growth in spring or on its cessation in late summer, but in general a greater % of the year's diameter growth occurred earlier in the growing season on the poorer, than on the better, sites, thus probably indicating that soil moisture becomes critical on poorer sites in the later part of the growing season and retards growth. Nearly 97% of the variation in the mean growth values of the different plots was accounted for by their site indices, the 5-year minimum for available soil moisture on site index 80 being 0·0 in., and on site index 180, 3·5 in.

4767. KOIVISTO, P. Om tillväxtskillnader mellan vårt- och glasbjörkbestånd. **[Differences in growth rate between stands of *Betula verrucosa* and *B. pubescens*.]** *Norrlands SkogsvFörb. Tidskr.* 1960 (1), (1–6). 12 refs. [Sw.]

Presents tabulated data based on measurements on 56 sample plots of *B. verrucosa* (*v*) and 20 of *B. pubescens* (*p*) in S. Finland, showing top height, crown %, length of clear stem, and mean diameter at 10-year intervals in the range 20–80 years. Top height of *v* was greater than that of *p* (11·5 and 8·5 m. respectively at 20, and 23·8 and 19·3 at 60 years). Crown depth of the two species was similar. Crown % of *v* was 53 at 20 years, decreasing to 45 by 50 years and remaining constant thereafter. Mean diameter of *v* was superior to that of *p* (7·7 and 6·0 cm.

respectively at 10, and 21·8 and 18·4 cm. at 60 years). Radial increment of *v* responded rather more strongly to thinning in the first 3–7 years than that of *p*. Dominant trees appear to be little affected by thinning during the first 30–40 years after thinning, and light thinning up to 30–35 years followed by heavier thinning at longer intervals is recommended. Although growth rates of *v* are superior to those of *p*, its total yield of wood is much below that of conifers, and much more of it consists of small material.

4768. NASH, A. J. **Growth in well-stocked natural Oak stands in Missouri**. *Res. Bull. Mo. Agric. Exp. Sta.* No. 700, 1959. pp. 20. 11 refs.

In 1956, 75 plots established in 1951 in well stocked upland Oak stands were remeasured. The mean volume was 3230 bd. ft./acre, vs. the mean for Missouri of 789. Graphs are given showing bd.-ft. volume as a function of b.a./acre in trees with d.b.h. $\geqslant$ 10 in., for different areas in the state, together with a comparison between volumes on N. and S. aspects. A graphic method of predicting future volume, based on past performance, is given, with graphs showing the volume growth rate of *Quercus alba*, *Q. velutina*, and *Q. stellata*.

4769. HOLDRIDGE, L. R. Crecimiento del "laurel", *Cordia alliodora* (R. & P.) Cham. [**Growth of *C. alliodora*.**] *Comun. cient. agríc. Inst. Interamer. Cienc. Agric., Turrialba* (*Dasonomía*) Hoja No. 8, 1958. pp. 3. [Span.]

Tabulates data on diameter and b.a. increment for 1956–57 and 1957–58, in a $\frac{1}{10}$-acre plot, established in 1954 in Costa Rica.

4770. COZZO, D. Las plantaciones con "peteribí" (*Cordia trichotoma*) en la Provincia de Misiones. [**Plantations of *C. trichotoma* in the province of Misiones.**] *Rev. for. argent.* 4 (1), 1960 (11–4). [Span.]

Cordia trichotoma, one of the most valuable Argentine timbers, reproduces itself abundantly in favourable conditions and grows rapidly during the first years of life, but, owing to its extreme frost susceptibility, it rarely develops into a pure, full-grown stand. It coppices readily after injury by low temperature but, in such circumstances, never reaches the stage of high forest. Artificial plantations established by farmers (usually $\ngtr$ 2 ha. in extent) have succeeded in sheltered positions, but not in the open, where they became stunted and excessively branchy. Observations on 5 such plantations led to the following conclusions. Diameter m.a.i. in the first 2–3 years is 2–3 cm.; later it falls to a mean of 1·5 cm., which can be accepted as the optimum mean during the first 10 years of the plantation's life. Height m.a.i. in uninjured stands with a stocking of 1000 stems/ha. is 1 m. In stands with high initial stocking and submitted to periodic improvement fellings a volume m.a.i. of 20 cu. m./ha. may be expected. It is essential that the stands should be sheltered. A possible method is to establish strips or circular plantations within existing (natural or artificial) forest.

4771. **1958 annual report, Tropical Forest Research Center [Puerto Rico]. Advanced Mahogany [*Swietenia mahagoni*] plantation growth.** *Carib. For.* 20 (1/2), 1960 (4–5). [E.]

Records of growth and development were compared from two 27-year-old plantations on the Luquillo Mts. (1) is a dense pure stand; (2), because of early mortality, consists of scattered Mahogany above natural regeneration of other species. (1) was unthinned until its 20th year and has been kept at a b.a. > 100 sq. ft./acre. Mean diam. of dominants and co-dominants is now 14 in., with a maximum of 18 in. Natural regeneration appeared first in the 23rd year, and first-year seedlings are now plentiful. Diam. p.a.i. of the dominants and co-dominants is ca. 4 in. per decade. (2) has dominants and co-dominants averaging 18 in. in diam., with a maximum of 24 in. Tree form is good. Diam. p.a.i. of dominants and co-dominants for 1952–57 exceeds 6 in. per decade. Natural regeneration of Mahogany, however, has been suppressed by the understorey of other species.

61. Increment in Height, Diameter, Basal Area, Form and Quality. Variations and Trends; Dendrochronology

See also Nos. 4172, 4227, 4432, 4649, 4728, 4867, 4943–4.

4772. SWIEDRIS [ZVIEDRIS], A., and BROKS, J. [**Girth increment and crown size in Silver Fir.**] *Latvijas PSR Zinātņu Akadēmijas Vēstis, Riga* 1959 (3), 1959 (101–6). [Russ.?] From *abstr.* in *Holzforschung, Berlin* 14 (2), 1960 (59). [G.] P.R.

Investigations on 178 sample stems showed a close correlation between crown volume and timber increment. Wood volume production per unit of crown volume is greater with Firs of smaller diameters than with those of larger diameters. Younger trees also exhibit relatively greater wood volume production per unit of crown volume. For a given diameter class, trees with large crowns exhibit a smaller [wood] volume increment [per unit of crown volume?]. Therefore, in thinnings the relatively older trees with large crowns should be removed.

4773. SMITH, J. H. G., and KER, J. W. **Growing Douglas Fir and Western Hemlock trees at desired rates.** *Res. Note Fac. For. Univ. B.C.* No. 24, 1960. pp. [5]. 14 refs.

Summarizes some basic relationships that affect growth rate (g.r.) and suggests that g.r. can be manipulated by varying the ratio of crown width (c.w.) in ft., to d.b.h. in inches. The over-rapid diameter growth of the two species is likely to be a problem only on the best sites; within the most fully stocked natural stands, the most vigorous trees will attain twice, and the least vigorous one-half, the mean stand diameter. Max. g.r. is attained when the c.w./d.b.h. ratio is that of open-grown trees; for Fir and Hemlock of > 8 in. d.b.h. this ratio is ca. 2/1. By controlling the ratio of c.w. to d.b.h., any desired g.r. ranging from that of a fully stocked stand (1/1) to that of an open-grown stand (2/1) can be attained.

4774. SMITH, H. F., and DUBOW, D. A. **Crown length and crown ratio as indicators of diameter growth of Loblolly Pine [*Pinus taeda*].** *For. Sci.* 6 (2), 1960 (164–8). 6 refs.

To examine critically how crown and stem lengths are related to the vigour of *P. taeda* as reflected in periodic diameter growth, data were collected from 3 plantations in N. Carolina: (*A*) 19 years, 2 acres, 26 plots; (*B*) 15 years, 2 acres, 26 plots; (*C*) 13 years, $1\frac{1}{2}$ acres, 22 plots. Observations were made of the central two rows of each plot (initially planted with 80 trees but now containing (*A*) 6–14, (*B*) 11–20 and (*C*) 12–18). A 3-year diam. growth was found to have a correlation coefficient of ca. 0·75 and to be slightly, but positively, related to stem length. The live-crown-length/total-height ratio was not a satisfactory index, since it assumes a negative correlation between diameter growth and stem growth that is not found in an even-aged stand. It is suggested that, for silvicultural and mensurational investigations, recording the direct observations of crown size will save computing labour by explicitly dealing with direct measures of that character itself, not masked by confusion with an arbitrary ratio.

4775. CHURCH, T. W., JR. **Initial effect of residual stocking levels on basal area production in northern hardwood stands.** *Tech. Note Lake St. For. Exp. Sta.* No. 581, 1960. pp. 2.

In a study in old-growth hardwood stands on the Duke Experimental Forest, replicated plots were cut to (*a*) 30, (*b*) 50, (*c*) 70, and (*d*) 90 sq. ft. o b.a./acre in trees ⩾ 10 in. d.b.h. After 5 years, net growth, mortality, and gross b.a. production were calculated. Gross b.a. production was significantly less for (*a*) than for (*b*), (*c*) and (*d*); (*c*) gave largest gross and net production—ca. 170 bd. ft./acre compared with 150 for (*b*) and (*d*). Residual stocking level had no significant effect on b.a. production of trees of 5–9 in. d.b.h., though production was greatest for (*a*) and least for (*c*). Mortality was also greatest in (*a*).

4776. PHIPPS, R. L., and GILBERT, G. E. **An electric dendrograph.** *Ecology* 41 (6), 1960 (389–90).

A newly designed, electrically operated dendrograph was in operation throughout the 1959 growing season in connexion with a study of radial increment being made at Neotoma, Ohio, by the Department of Botany and Plant Pathology, Ohio State University. Its results have been highly satisfactory and its advantages over other growth-measuring devices are now evident. The basic component is a Pancake Rectipot Potentiometer (G. M. Giannini Co., Inc., Pasadena, Calif.), which is mounted in a small plastic housing and secured to the tree by adjustable screws anchored in the xylem. Since only two mounting screws are required, the instrument can be easily secured to stems as small as 3 in. in diam. The movable shaft of the Rectipot is held to the stem by a small screw in the outer bark, so that any change in the outer radius of the tree causes an equal displacement of the shaft. Shaft displacement can be remotely measured as a change in electrical resistance, which, in the Neotoma studies, is measured by a Leeds and Northrup multipoint strip chart recording ohmmeter. Advantages of the electric dendrograph are: (1) remote measurement-reading or recording of radial change at one station for a number of stems located at different points; (2) any one of a variety of non-portable measurement-reading devices can be used; (3) small size: the dendrographs can be placed on trees of small diameter, or in relatively inaccessible places such as high in a tree; (4) low initial cost of sensing element and housing (ca. $70.00); (5) ease and low cost of installation; and (6) maintenance involving only the adjustment of mounting screws before each growing season.

4777. MESAVAGE, C., and SMITH, W. S. **Time-savers for installing dendrometer bands.** *J. For.* 58 (5), 1960 (396). 1 ref.

Describes two methods of making and installing dendrometer bands: (1) an adaptation of Liming's method [cf. *F.A.* 19 No. 802] to reduce field work; (2) a 3-in. scale-stamp giving subdivisions of $\frac{1}{10}$ in.; though more expensive than a template for hand-scribing bands it saves its cost when many bands are required.

4778. ABETZ, P. Die Genauigkeit der Radialzuwachs- und Jahrringbreitenmessung mit der Eklundschen Jahrringmessmaschine an Stammscheiben und Bohrspänen. **[The accuracy of measurements of radial increment and width of annual rings by means of the Eklund instrument on cross-sections and increment cores.]** *Allg. Forst- u. Jagdztg.* 131 (4), 1960 (74–80). 2 refs. [G.g.e.]

While measurements on cross-sections are considered possible with a considerable degree of accuracy, there are many sources of error and inaccuracy in measurements of increment cores, a chief difficulty being the fact that on most trees the sum of widths of successive annual rings as measured is more than the actual radial growth, since in excentric or non-circular trees few radii cut the annual rings at an angle normal to the tangent at that point. [Cf. *F.A.* 12 No. 3501; 20 No. 2177.]

4779. KERN, K. G., and MOLL, W. Der jahreszeitliche Ablauf des Dickenwachstums von Fichten verschiedener Standorte im Trockenjahr 1959. **[The seasonal course of diameter growth of Spruce on various sites during the drought year 1959.]** *Allg. Forst- u. Jagdztg.* 131 (5), 1960 (97–116). 41 refs. [G.g.e.]

Diameter growth was measured from April to Oct. on 5–7 trees in 10 stands, mostly of middle age, at 230–1350 m. alt. in the Rhine valley and Schwarzwald. There was close correlation between the readings of the Arnberg microdendrometer [cf. *F.A.* 21 No. 847] and increment-core readings, the former being consistently higher (from 9%, i.e. 0·38 mm. higher in dominants, to 23%, i.e. 0·29 mm., in suppressed trees). Growth ceased earlier in 1959 than in 1958; its cessation (unlike its inception) was not correlated with altitude. Distribution of growth over the season varied considerably, the slower growing trees, in particular, completing most of their growth in the first half of the growing season. Position in the canopy, however, did not greatly affect growth pattern. During the July–Aug. heat wave, growth, particularly at the lower altitudes, was negatively correlated with temperature and with duration of sunshine, but positively with precipitation, air humidity and cloud cover. Comparisons with previous years, made for the drought years 1959, 1949, 1947 and 1934, showed marked reductions in increment only in some lowland sites. In some high sites there were even increases, suggesting that warmth rather than water was the decisive factor.

4780. BANNISTER, B. **Tree-ring dating of archaeological sites in the Chaco Canyon region, New Mexico.** *Abstr. of thesis*, in *Dissert. Abstr.* 20 (9), 1960 (3702–3). O.R.S.

An analysis of 828 tree-ring dates from 46 sites has revealed five broad occupational periods for the region, covering a span of 13 centuries from the late 600s to the present day.

562. Volume Increment

See also No. 4795.

4781. BAKER, F. S. **A simple formula for gross current annual increment.** *J. For.* 58 (6), 1960 (488–9). 2 refs.

Discusses the origin and use of the 'Schneiderlein' formula: $I = (D \times H \times W)/100$ or $I = (D \times H)/(RI \times 100)$, where I = annual increment in cu. ft., D = d.b.h. under bark, H = height in feet, W = width of last complete ring (in inches), and RI = rings per inch (based on the latest period of uniform growth). The second form of the expression is preferred for practical use.

4782. EMROVIČ, B. Die Ermittlung der Massenzuwachsprozente mit Hilfe des Tarifdifferenzverfahrens. **[Finding volume increment % by means of a method of tariff differentiation.]** *Schweiz. Z. Forstw.* 111 (3), 1960 (182–9). 10 refs. [G.f.]

Discusses a method of computing volume increment % (p) from x (= d.b.h.), Z_x (= c.a.i. of d.b.h.) and $f(x)$ (the basic function underlying a family of tariffs) using the formula $p = \rho_1 \,.\, 100Z_x$ where $\rho_1 = \dfrac{df(x)}{d(x)} \cdot \dfrac{1}{f(x)}$. Values of ρ_1 are tabulated for some of the most commonly used volume tables and tariffs. A method of correcting for the "shifts" in the tariffs applicable to a given even-aged stand, as a consequence of its ageing, is also discussed.

4783. BEATON, A. **Calculation of increment and stand prediction in tropical high forest, Uganda.** *Tech. Note For. Dep. Uganda* No. 82, 1960. pp. 33 + 10 gphs. 51 refs.

The investigation was in two parts: first, a study of methods of measuring increment and the possibility of adapting these to tropical high forest conditions; secondly, very limited research into the probable forms that growth might take for trees growing in conditions of considerable freedom throughout their lives. As a result of this investigation it is considered that a forecast of the growth and yield of the final crop stems is possible. The lines on which this can be done in practice are indicated, and tentative proposals for sample-plot measurements made.

4784. JACK, W. H. **A "check" method applied to tropical high forest.** *Emp. For. Rev.* 39 (2), 1960 (195–201). 4 refs.

The stocking of trees over "exploitable" girth limits on ca. 2000 acres [in the Bobiri Forest Reserve, Ghana] in 1955–58 was compared with the stocking 9½ years earlier, taking fellings in the intervening period into account. By the use of stock maps and a field check, the reasons for differences between net ingrowth and actual recruitment into this size class (9 ft. girth) were determined. It is suggested that comparisons of this nature, with an examination of the size-class distribution from 1 ft. girth up to the exploitable limit, and sampling to determine the progress of regeneration and seedlings, would provide an efficient way of controlling selection fellings to give a sustained yield or to ensure sufficient mother trees in an area for conversion while liquidating present mature stock. *From author's summary.*

564. Forecasting Increment

See also Nos. 4768, 4783.

4785. RUDAKOV, V. E. K probleme prognoza prirosta derev′ev. **[The problem of increment prediction.]** *Dokl. Akad. Nauk SSSR* 130 (3), 1960 (686–9). 6 refs. [Russ.] A.P.B.

Using a method already described [see *F.A.* 20 No. 3591], the author determines the modular coefficients of the annual diameter increments of two felled Scots Pine (121 and 161 years old) from the Buzuluk forest. The correlation between the coefficients and twice the precipitation (in mm.) of the preceding autumn–winter period plus the precipitation for the hydrological year (Oct. to Sept.) preceding this period was $r = 0{\cdot}46 \pm 0{\cdot}09$. The relations of annual increment to m.a.i., and to the increment of the previous year are also discussed.

566. Yield Tables and Their Construction

See also No. 4388.

4786. BJÖRGUNG, E. Lokale produksjonstabeller i skogbruket. **[Local yield tables in forestry.]** *Norsk Skogbr.* 6 (7), 1960 (235–7). [Nor.]

A formula in which the volume is directly proportional to $\sqrt{\text{number of stems}} \times (\text{mean height})^2$ was tested in (*a*) natural Spruce stands with satisfactory crown density, (*b*) artificial stands, and (*c*) the plots used by Braathe in a study of sparse regeneration [see *F.A.* 16 No. 2046]. Results show that the formula can be used satisfactorily for (*a*) and (*b*) regardless of site class or thinning grade, but less certainly for (*c*). Graphs are given showing the effect on results of the apparent increase of mean height after thinning and how the amount removed and the volume increment can be determined. The use of the method in practice is discussed. The values obtained showed good agreement with smoothed values from yield tables. The method has also been successfully applied to Pine and Aspen.

4787. VOLQUARDTS, G. Ertragskundliche Untersuchungen über die Esche in Schleswig-Holstein. **[Investigations on yields of Ash in Schleswig-Holstein.]** *Forst- u. Holzw.* 15 (8), 1960 (156–8). 9 refs. [G.g.]

Investigations on sample plots throughout Schleswig-Holstein, in order to test the validity of the Wimmenauer yield tables (1919), resulted in a new Ash yield table showing definite differences from the Wimmenauer table, e.g. height m.a.i. was about half a yield class higher. The new table showed good agreement with Danish and Swedish yield tables.

569. Increment; Development and Structure of Stands: Miscellaneous

See Nos. 4143, 4424, 4756.

58. Surveying and Mapping. Aerial Survey

See also Nos. 4379, 4532, 5196.

4788. STARODUMOV, JU. N. Issledovanie točnosti opredelenija prevyšenij kipregel′nym vysotomerom-avtomatom VKG-3. **[Investigation of the accuracy of determining differences in elevation with the VKG-3 automatic alidade hypsometer.]** *Lesn. Ž., Arhangel′sk* 2 (1), 1959 (107–11). 2 refs. [Russ.]

Describes the instrument and its use. The standard error of observations at 1 km. was ± 5·3 cm., and at 100 m. ± 1·7 cm.

4789. **Use of transparent grids in the measurement of areas.** *For. Adv. Newslett. Colon. Off., Lond.* No. 7, 1960: *Appendix A.* pp. 3. Limited distribution. I.F.B.

A note from the Forestry and Land Use Section, Directorate of Overseas Surveys.

4790. MOESSNER, K. E. **Training handbook. Basic techniques in forest photo interpretation.** Intermountain Forest and Range Experiment Station, Ogden, Utah. 1960. pp. 73.

A handbook prepared for instructors in photo interpretation. It introduces a series of laboratory exercises designed to train students in elementary stereovision and basic photo measurements, and their practical application in problems of photo sampling, aerial estimation of timber volume, and road location. Accepted answers to the exercises (obtained separately, in loose-leaf form with the necessary photos and aids), a brief discussion of training methods, and a glossary of > 90 terms are presented.

4791. POPE, R. B. **Ocular estimation of crown density on aerial photos.** *For. Chron.* 36 (1), 1960 (89–90).

Describes two procedures devised at the Northwest Forest & Range Experiment Station, Portland, Ore., to supplement standard methods on small areas (e.g. ⅕-acre plots).

4792. AVERY, G., and MEYER, M. P. **Volume tables for aerial timber estimating in Northern Minnesota.** *Sta. Pap. Lake St. For. Exp. Sta.* No. 78, 1959. pp. ii + 21. 8 refs.

Describes the use of tables for Rocky Mountain conifers and Kentucky hardwoods and a composite table for Mississippi, to calculate the volumes of 50 1-acre plots representing a wide range of hardwood and conifer volume classes near Cloquet, Minn. The figures obtained are compared with field figures, and a preliminary composite aerial volume table is derived for N. Minnesota by multiple regression techniques. A method of integrating plot and field determinations of timber volume is also presented.

4793. DILWORTH, J. R. **Aerial photo-mensuration tables.** *Res. Note For. Res. Div. Ore. Agric. Exp. Sta.* No. 2, 1959. pp. 8.

Presents aerial-photo volume tables for second-growth Douglas Fir and mature Ponderosa Pine stands in Oregon. The tables, showing the relationship between d.b.h., total tree height, and visible crown diameter were derived from measurements taken on the ground, the multiple regression method being used to correlate the three variables.

6. FOREST MANAGEMENT. BUSINESS ECONOMICS OF FORESTRY. ADMINISTRATION OF FOREST ENTERPRISES

61. Forest Management: General, Theory and Principles

See also No. 5218.

4794. CAMERON, R. J. **The indigenous forests of New Zealand, intensive and extensive management.** *Emp. For. Rev.* 39 (2), 1960 (185–94). 7 refs.

Intensive management would be practicable in only a small % of native forests. Even- and uneven-aged systems of silviculture are discussed with reference to suitability for particular timber species. It is suggested that sustained yield might be obtained from further large areas of forest by more casual techniques of extensive management.

4795. ROUSSEL, L., and LEROY, R. Le cycle d'évolution des peuplements dans la forêt domaniale de la Fuvelle. **[The cycle of development of stands in the state forest of Fuvelle.]** *Bull. Soc. For. Franche-Comté* 30 (2), 1960 (78–81). [F.]

The authors apply their theory of the relation between c.a.i. and volume of growing stock [cf. *F.A.* 18 No. 789] to the available data for this forest for the periods 1913–37 and 1938–56.

62. Methods of Management. Working Plans. Annual or Periodic Yield. Yield Regulation

See also Nos. 4223, 5221.

4796. ZEHNGRAFF, P., *et al.* **Forest management guide for Taiwan.** *Forestry Series, Chinese-American Joint Commission on Rural Reconstruction, Taipei* No. 6, 1959. pp. 25 + 1 map. 18 refs. [E.]

Discusses briefly the objectives of management in Taiwan, gives a general description of the forests, with tabulated data on area of forest land, its accessibility, species, etc., and a more detailed description of forest types (conifer, mixed conifer/hardwood, hardwood/Bamboo) and discusses plans for felling (general, and calculation of allowable cut), for managing protection forests, afforestation (annual areas for afforestation in a 40-year period and choice of species), and road development (with a map on the scale 1 : 1,000,000).

4797. ANUČIN, N. P. Novyj metod opredelenija razmera glavnogo pol′zovanija lesom. **[A new method of determining the cut in principal fellings.]** *Vestn. sel′.-hoz. Nauki, Moskva* 5 (5), 1960 (112–9). 4 refs. [Russ.e.g.f.]

Proposes a method of calculating principal fellings which takes into account the growing stock of all age classes in the stand. Examples of its use are given for *Pinus sylvestris* in the Vladimir region and *Picea abies* in Belorussia.

4798. JOHNSTON, D. R. **Problems of yield control and inventory in British forestry**. *Forestry* 33 (1), 1960 (19–36). 2 refs.

(1) The greater part of the output from British forests during the next few years will come from thinnings. Final fellings will come predominantly from overmature crops which are a legacy from the past, or from unsatisfactory crops. Yields from thinning and felling must therefore be considered quite separately. Thinning yields will depend upon increment, but yields from final felling will depend mainly upon the area of overmature crops to be removed within a predetermined period of years. The data required for thinning and felling control are discussed. (2) The theory of sampling in relation to forest enumeration is discussed briefly. The standing volume of a forest may be estimated in three ways: by the application of yield tables; by visual estimation; or by measurement. The last method may mean measuring all the trees or only a sample, and the theory of enumeration-plot procedure is discussed. Increment may be estimated by comparing successive enumerations of the standing crop; from yield tables; or from measurements within the tree. Finally the choice of enumeration method is discussed. *Author's summary*.

64. Forestry as a Business: General

See also No. 5235.

4799. HART, C. E. **Woodlands as an attractive investment**. *Repr.* from *Chartered Surveyor, London* April, 1960. pp. 4. 4 refs.

Outlines tax and estate-duty concessions, state grants for planting, management and scrub clearing, and briefly discusses yields to be expected, choice of species, rotations, thinnings, etc. and the combination of forestry with other uses, particularly pheasant shooting. [Cf. *F.A.* 21 Nos. 2613, 3599.]

4800. STREYFFERT, T. Synpunkter på skogsbrukets ekonomi. **[The economics of forestry [with discussion].]** *Svenska SkogsvFören. Tidskr.* 58 (2), 1960 (105–51). [Sw.]

A general lecture ranging over many problems, including possibilities of raising volume yields and financial profits, and reducing costs. The detailed discussion includes contributions by: *S. Fahlgren*, advocating large, concentrated final fellings, with no intermediate fellings in the second half of the rotation, to utilize fully the advantages of mechanization, and claiming that the gains in logging costs would outweigh losses in increment; *G. von Malmborg*, discussing the special conditions of farm forestry (where labour is a relatively fixed factor of production) and presenting data from a survey for 1954–58 of prices and fellings, volume increment, costs and profits etc., and showing, on the whole, a deterioration of the financial position combined with under- rather than over-cutting; *T. Ellström*, dealing with the relation of direct and indirect costs and revenue per cu. m., break-even point, etc., on the basis of data for 4 state enterprises for 1954 to 1958; and *M. Nordquist*, discussing rises in productivity, particularly in relation to capital invested per worker in forestry, the forest industries, and other sections of the economy.

4801. KISHINE, T. **A study on the determining of the optimum plan in forestry management economy**. *Memoirs of the College of Agriculture, Kyoto University* No. 79, 1958. pp. 75. 20 refs. [E.]

A trial application of the technique of linear programming to the economics of forest management, with sections on determining an optimum plan as regards (*a*) production (choice of species, and times of intermediate and final yields), (*b*) distribution (transport) and (*c*) the two combined, and on amending the plan as conditions change.

4802. KISHINE, T. **A method whereby both the optimum species of trees and the optimum cutting ages can be determined simultaneously**. *Memoirs of the College of Agriculture, Kyoto University* No. 79 (*Suppl.* No. 1), 1958. pp. 13 + 8 tbls. 22 refs. [E.]

A supplement to the earlier paper [cf. preceding abstract], involving 5 different plans, including two that include fertilizers and their economic effect.

4803. JEUTHE, H. Zum Begriff, zur Steigerung und zur Messung der Arbeitsproduktivität in der Forstwirtschaft. **[The concept of productivity in forestry, its increase and its determination.]** *Schriftenreihe für Forstökonomie, Ministerium für Land- und Forstwirtschaft, Berlin* No. 4, 1959. pp. 56. 30 refs. [G.]

Considers that, because of the long-term production period and its dependence on complex biological and ecological factors, determination and meaningful comparisons of total, i.e. biological-operational, productivity in forestry are virtually impossible, but that operational productivity can be measured with various degrees of accuracy by reference to the productivity of the different production stages—soil preparation, planting, etc. Examples are given, with discussions on the degree of breakdown necessary, the additions to be made to the notional values of the product (ploughed area etc.) over and above the average cost of work and materials (by reference to the ratio that productive wages bear to national income in E. Germany), the adjustment for work performance according to local conditions (based on difficulty ratings in wages tariffs, etc.), and the handling of the necessary data in the accounts.

4804. FRAUENDORFER, R. Betriebswirtschaftliche Untersuchungen im steirischen Bauernwald (Gemeinde Haslau 1955). **[Investigations on the business economics of farm woodlands in Styria (Haslau parish, 1955).]** *SchrReihe forstl. VersAnst., Mariabrunn* No. 7, 1958. pp. 157 + 1 map. [G.]

A pilot survey in a backward, subsistence-farming area of E. Styria, describing stocking, composition, increment, condition etc. of these primitive (mostly coniferous) selection-type forests and the sampling and recording methods applied (all data were entered in coded form ready for machine processing). The role of forestry in the economics of these farms, and in their planned conversion to more viable units is discussed. With judicious marking, a sustained annual cut of 5 cu. m./ha. yielding a higher income than any from agricultural use would be possible. Left to local practice, a similar drain would soon deplete the forests.

65. Special Business Problems of Timber-Growing. Calculation of Costs and Profitability. Valuation

See also Nos. 4247, 4361, 4399, 4401, 4413.

4805. WOBST, A. Die Gestehungskosten in der Forstwirtschaft. **[Production costs in forestry.]** *Forstarchiv* 31 (5), 1960 (57–66). 24 refs. [G.]

A detailed discussion of costs of production and profitability in German forestry at the present time, with particular reference to the methods of calculation used by J. Speer [cf. *F.A.* 21 No. 3608].

4806. BENNETT, H. D. **Sound practical, economic forestry is a good investment.** *Sth. Lumberm.* 199 (2489), 1959 (136–8).

In a 20-acre plot of Appalachian hardwoods on which 140,000 of the original 230,000 bd. ft. were cut in 1948, the volume had grown in 1958 to nearly 134,000, thanks to proper protection against grazing and fire. The increment is estimated as equivalent to 6% compound interest.

4807. FUNAKOSHI, S. **[Study on the calculation of rentability [profitability] of forestry—especially on the calculation of rent [profit] of silvicultural investment.]** *J. Fac. Agric. Iwate Univ.* 4 (2), 1959 (159–66). 8 refs. [Jap.e.*e.*] O.R.E.

In this tentative study, the author, deprecating a fixed interest rate in calculating the profitability of long-term forest management, takes the ratio of varied/fixed assets as a guide; below a ratio of 56%, he takes the ruling market interest rate; between 56 and 300%, the mean interest rate earned by agricultural holdings; above 300%, a higher interest rate. Those principles are applied, in illustration, to an actual case of Government forest working.

4808. NYYSSÖNEN, A. Kiertoaika ja sen määrittäminen. **[Rotation and its determination.]** *Commun. Inst. For. Fenn.* 49 (7), 1958 (1959). pp. 87. 96 refs. [Fi.e.*e.*]

Examines in detail the effect of various factors on optimum rotation as determined from the marginal rate of return [cf. *F.A.* 13 No. 3253]. These factors include: site class; tree species; the rate at which interest is calculated; stumpage price; demand for different sizes of timber; regeneration costs.

4809. MØLLER, C. M. Værdiforskellen på gode og dårlige ældre bevoksninger af bøg. **[The difference in value between good and poor established Beech stands.]** *Dansk Skovforen. Tidsskr.* 45 (2), 1960 (101–6). [Dan.]

Presents tabulated data collected in 1958–59 from five districts, showing the relative prices in Kr./cu. m. and the % differences between the poor and good stands for both felled and remaining timber, with some complementary data for 1956–57.

4810. KJØLLER, P. Om hedeplantagernes vurdering og beskatning. **[Valuation and taxing of heathland plantations.]** *Dansk Skovforen. Tidsskr.* 45 (5), 1960 (167–79). [Dan.]

Explains the present position, with examples calculated by the current and earlier Danish tax laws.

66. Costing of Logging Operations

See also Nos. 4436, 4442, 4447, 4475, 4821.

4811. ROMANOV, E. S. Sravnitel′nyj analiz sebestoimosti traktornoj i trosovoj trelevki. **[Comparative analysis of the costs of tractor and winch skidding.]** *Lesn. Prom.* 1960 (4), (25–6). [Russ.]

Compares skidding costs of TDT-40 and TDT-60 tractors, with those of TL-4 and TL-5 endless cable winches in relation to size of load, skidding speed and distance, mean stem volume, and volume/ha. It is concluded that, on flat ground and with a mean stem volume $\leqslant 0{\cdot}4$ cu. m., skidding should be done by tractors of 60–80 h.p. Winches should be used for stems $> 0{\cdot}4$ cu. m. and for short skidding distances.

4812. DAHLFORS, B. Kostnaderna för skogshäst och utrustning. **[The costs for horses used in forestry and equipment.]** *Skogen* 47 (12), 1960 (235–6). [Sw.]

Presents tabulated cost data for horses, based on factors somewhat modified from those already described [see *F.A.* 19 No. 856], for equipment (sledges, tongs, loading equipment, chains, etc.), and for horses and equipment together, for light, normal and heavy work on 50–300 days per year.

4813. ALEXANDERSON, B. Vad kostar det at hålla skogshäst? **[The cost of keeping horses in forestry.]** *Skogen* 47 (13), 1960 (250). [Sw.]

Presents data, supplementary to those of Dahlfors [see preceding abstract] on initial cost and costs of fodder, grazing, labour, stabling, veterinary services, and insurance of a horse from ½ to 3½ years.

4814. TRIMBLE, G. R., JR., and BARR, C. A. **Cost of skid roads for arch logging in West Virginia.** *For. Res. Note Ntheast. For. Exp. Sta.* No. 97, 1960. pp. 4.

Compiled from logging operations over 660 acres in Fernow Experimental Forest, West Virginia. The mean cost of permanent main skid roads, made with a TD-9 tractor and bulldozer, was $318 per mile. Of this, road location and care after logging took ca. 9% each, much less than the cost of building new roads for future operations. On the average, 65 ft./acre of bulldozed main skid road and 74 ft./acre of non-bulldozed spur road were constructed, costing $4.70/acre, with a mile of road serving 38 acres. This cost was modest, and most of it was capital investment that will not need to be repeated.

67. Assessment of Financial Results; Book-keeping and Accountancy; Business Statistics; Short-Term Planning and Financing

4815. HATT, P., and LEBRUN, R. Méthodes employées dans les forêts suédoises pour les calculs de rentabilité des investissements. **[Methods used in Swedish forests for the calculation of returns on investment.]** *Rev. for. franç.* 12 (5), 1960 (309–26). [F.]

A description, with examples, of methods of calculating returns on investment used in industry and applied in Sweden to forestry. Formulae for determining the operational cost of machinery and the optimum density and required quality of forest road networks are discussed in detail.

4816. HODAPP, W. Die Eingliederungspläne der öffentlichen Forstverwaltungen in der Bundesrepublik Deutschland. **[The systems of heads [for financial accounting and budgetting] of W. German state forest administrations.]** *Allg. Forst- u. Jagdztg.* 131 (6), 1960 (134–40). 9 refs. [G.g.]

Discusses the legal and financial framework in which forest departments of the Federation, the states, and local authorities operate. Owing to their dual function as organs of administration and state enterprises, forestry departments are not, like some public utilities, freed from certain rules of detailed accounting for income and expenditure by reference to budget estimates and allocations, and their systems have too little flexibility and provide no automatic basis for the determination of profit and loss. A table comparing the chief expenditure heads of the German states is presented.

4817. MERVART, J. Příspěvek k problematice základní kontroly vlastních nákladů výroby v lesním hospodářství. **[On the problem of basic cost control in forestry.]** *Práce Výzkum. Úst. Lesn. ČSR* No. 16, 1959 (201–31). 6 refs. [Cz.cz.russ.g.]

The principles, uses and advantages of a method proposed by the author are discussed.

68. Administration and Organization of Forest Enterprises

684. Labour Management

See also Nos. 4428–9.

4818. LOYCKE, H. J. Arbeitsplanung, eine Voraussetzung sinnvoller Arbeitsführung. **[Operational planning, a pre-condition of rational labour management. [With an editorial introduction.]** *Forsttech. Inform., Mainz* 1959 (2), (8–14). 13 refs. [G.]

Discusses, with examples, the need for plans, covering a number of years while remaining flexible, based both on a detailed analysis of actual working times taken by men, women, and machines on various jobs month by month, and also on standard times computed from work studies, regional averages, etc., assuming various degrees of mechanization, work sequences, etc., and selecting the most advantageous.

7. MARKETING. ECONOMICS OF TRANSPORT AND THE FOREST PRODUCTS INDUSTRIES

71. Marketing of Forest Products: General

See also Nos. 5184, 5235.

4819. CROW, G. B. **U.K. market for Western Hemlock**. *Timb. Tr. J.* 233 (4371), 1960 (71–3).

Considers working qualities, present methods of conversion, grading and bracking, and particularly recommends, for the elimination of present objections, progressive kiln drying and new *ad hoc* grading rules to cover the limited number of grades and sizes involved.

72. The Quantitative Aspects of Marketing. Demand, Consumption and Supply

See also Nos. 4124, 4983–4, 5017.

4820. BUBLIS, K. Minkštųjų lapuočių medienos suvartojimas Lietuvos TSR. **[The demand for timber of soft, broadleaved species in Lithuania.]** *Liet. Miškų Ūkio Moksl. Tyr. Inst. Darb.* No. 3, 1958 (229–48). 8 refs. [Lith.russ.]

An analysis of the position (supply and demand) as regards Birch, Aspen and Alder.

73. Prices

4821. NORDQUIST, M. Leveranspriser på virke och avverkningskostnader 1952/53–1959/60. **[Delivery prices for wood, and logging costs, 1952/53–1959/60.]** *Svenska SkogsvFören. Tidskr.* 58 (2), 1960 (153–61). [Sw.]

Analyses the fluctuations of prices for sawtimber, and sulphite and sulphate pulpwood at delivery point for 4 river floating systems, and, for two of them, the costs of logging, land transport and floating, all of which show a rising trend.

4822. HANSON, A. G., and WILSON, D. **The effect of price upon the consumption of sawn lumber.** *Aust. Timb. J.* 26 (1), 1960 (81 . . . 107).

Determines what changes are significant in the relative price of wood and its competitors over the period 1937–38 to 1957–58, for Australian conditions. Wood has not retained its pre-war importance as a building material, presumably mainly because timber rose more steeply in price than did its competitors. Intensification of research to cheapen and improve present production methods is urged as the chief way to improve the relative price of timber.

74. Trade Policy

See also Nos. 4214, 4824.

4823. Thurn, P. Österreichs Forstwirtschaft im Kräftespiel des Europamarkts. **[Austria's forestry in the interplay of forces on the European market.]** *Öst. Vjschr. Forstw.* 101 (1), 1960 (1–5). [G.]

A general discussion of prospects. In 1958 Austria, a member of the European Free Trade Association, exported 89% of its wood and wooden commodities, and 60% of its paper, to countries of the Six (chiefly Germany and Italy) and only 3 and 6% respectively, to members of the Seven.

75. Trade Customs and Usages

4824. **Documents and customs relating to the international trade of tropical woods.** Association Technique Internationale des Bois Tropicaux, Paris. [*n.d.*] pp. [248] + 8 plates. [F.E.]

The main part of the publication, given in both French and English, consists of official regulations, customs forms, specifications, grading rules etc. There is also a glossary of trade terms in French, English, German and Spanish. The whole is in loose-leaf form in an expanding folder to permit of additions.

4825. Rothé, P. L. Usages commerciaux en matière de bois tropicaux. Peut-on les internationaliser? **[Trade practices in the matter of tropical woods. Can they be internationalized?]** *Bois For. Trop.* No. 71, 1960 (55–68). [F.]

Discusses a recent publication [see preceding abstract] which attempts to select those practices that are generally recognized in the tropical timber trade.

78. Economics of Transport

See also No. 4821.

4826. James, L. M., and Lewis, G. D. **Transportation costs to pulpwood shippers in Lower Michigan.** *Quart. Bull. Mich. Agric. Exp. Sta.* 42 (3), 1960 (444–69). 1 ref.

Examines pulpwood hauling costs by rail and by road and indicates the comparative advantages and disadvantages of the two methods. Ca. 22% of wood delivered to pulp mills is transported by rail, vs. 78% by road. Road transport was found generally to be cheaper than rail for both buyer and seller, but factors other than price often influenced the choice of method.

79. Economics of the Forest Products Industries

See also Nos. 4994, 5104, 5160, 5177, 5190, 5200.

4827. **Pulp and paper demand, supply and trade.** *Unasylva* 13 (4), 1959 (202–12).

A report on the World Consultation on Pulp and Paper Demand, Supply and Trade held at FAO HQ at Rome, Sept. 1959. Data are presented on current and anticipated demand, and current production for the different regions of the world. [Cf. *F.A.* 21 No. 3627.]

4828. Sjunnesson, L. Den svenska massaindustrien och dess framtidsutsikter. **[The Swedish pulp industry and its prospects.]** *Svenska SkogsvFören. Tidskr.* 58 (2), 1960 (93–104). [Sw.]

Gives data on the development of output and capacity for various types of pulp and paper since 1937, and expansion projects in hand, and discusses world market trends.

4829. Champion, Sir H. **Development of wood-using industries.** *Nature, Lond.* 185 (4717), 1960 (894–5).

A review of 'Small Pulp Mill Survey, United Kingdom' and 'Board Mill Survey, United Kingdom' [cf. *F.A.* 21 No. 3835].

4830. **Small pulp mills: an economic enquiry into the possibility of establishing and operating small mills to produce pulp for use in the manufacture of paper, in Belgium, Denmark, France, Italy, the Netherlands and Great Britain.** Organisation for European Economic Co-operation, Paris. 1960. pp. 294. [E.F.] Price *N.Fr.* 12. 17*s.* 6*d.* $3.00. [Cf. *F.A.* 20 No. 5062.]

8. FOREST PRODUCTS AND THEIR UTILIZATION

See also Nos. 5188, 5190.

4831. Langhed, K. **Swedish wood technology achievements.** *Svensk Trävarutidn.* Annual issue, 1958 (1959), (99–101). [E.]

A summary report of the work of the Wood Technology Department, Swedish Forest Products Research Institute, Stockholm, on wood structure and properties, sawmill technology, seasoning, gluing and finishing, woodworking and plywood, timber mechanics and construction, and preservation.

4832. **[The Japanese wood industry.]** *Wood Ind., Tokyo* 15 (5), 1960. pp. 54. Many refs. [Jap.] P.R.

Contains mainly reviews and general articles on various aspects of mill practice and plywood handling (English titles listed). Includes also an original research paper by *S. Hirai, et al.* (with English summary) on the adhesive properties of *Pentacme contorta* plywood, chemically treated against attack by powder-post beetle.

4833. **[Forest products in Japan.]** *Wood Ind., Tokyo* 15 (6), 1960. pp. 50. Many refs. [Jap.] P.R.

The issue contains mainly reviews and miscellaneous reports on the forest products industry in Japan, and includes an original research paper by *N. Okada, et al.* (with English summary) investigating the relationships between the adhesive strength and thickness of veneers [species not given] in plywood manufacture.

4834. **50 years of service through wood research, 1910–1960.** *Misc. Publ. U.S. Dep. Agric.* No. 820, 1960. pp. [16].

Reviews the past work of the Forest Products Laboratory, Madison, Wis., in the investigation of wood and wood products, and outlines future plans.

4835. KÜBLER, H. Das Holzforschungsinstitut in Madison und der Steuerzahler. **[The Forest Products Research Laboratory at Madison and the taxpayer.]** *Holz-Zbl.* 86 (66), 1960 (920–1). [G.]

A discussion, for German readers, of the laboratory, its administration, equipment, working conditions, policy, financing, public relations, ministerial control etc. by a German who worked there for a year.

4836. JORGENSEN, R. N. Programa general para investigaciones en tecnología de maderas del Instituto Forestal Latinoamericano. **[General programme for research in wood technology of the Instituto Forestal Latinoamericano.]** *Bol. Inst. For. Latino Amer., Mérida* No. 5, 1960 ([i–ii], 1–33 + 2 plates). 26 refs. [Span.e.]

Presents (1) a brief introduction setting out the general lines along which research is to proceed and describing the laboratories of the Universidad de Los Andes that are used by the Institute; (2) a list of 390 Latin-American species with references to published literature on their timber properties; (3) results of tests made in the Institute on the physical and mechanical properties of *Spondias mombin*, *Samanea saman*, *Astronium graveolens*, *Albizzia caribaea*, and *Platymiscium polystachyum*; and (4) a short description of the apparatus used in experiments in the wood-preservation laboratory.

4837. SEABRA, L. DE. Possibilidades de aplicação das espécies ultramarinas nas diversas indústrias da madeira. **[Possibilities for the utilization of overseas species in various wood industries.]** *Estud. Ensaios e Docum. Junta Invest. Ultramar, Lisboa* No. 58, 1959. pp. 93 + 37 plates. 44 refs. [Port.f.e.]

A review based on post-war world literature, with special reference to the tropical hardwood resources of Portuguese overseas possessions and to work already done.

4838. VOGELER, R. Verzeichnis der Auslandsnormen für das Holzgebiet nach dem Stand vom Juni 1959. **[Foreign standards relating to wood as at June, 1959.]** *Holz-Zbl.* 85 (110; 113), 1959 (1469–73; 1511–4). [G.]

The standards are grouped under: Woodworking and manufacturing of wooden articles (by far the largest section); Testing of wood and wood-based materials; Drying; Gluing; Wood-based materials [including plywood]; Wood preservation; and Building regulations. In each section they are listed in alphabetical order of countries (32 countries) and, within each country, by serial number.

81. Wood and Bark: Structure and Properties

See also No. 5007.

810. General Information on Woods

See also Nos. 4099, 4101, 4116, 4123–4, 4214, 4836.

4839. CHOWDHURY, K. A., and GHOSH, S. S. **Indian woods, their identification, properties and uses. Volume I. Dilleniaceae to Elaeocarpaceae.** Manager of Publications, Government of India, Delhi. 1958. pp. liii + 304 + 35 plates, 1 sketch-map. Many refs. Price 39*s*.

The first volume of a work planned to comprise eventually 6 volumes, each dealing systematically with about 250–300 species, based chiefly on Gamble's Indian Wood Collection at the Forest Research Institute, Dehra Dun, brought up to date. The anatomical descriptions are supported by photomicrographs and short notes on habit, distribution, etc. Appendices include a table of mechanical properties, a classification by uses, and an index of trade and common names.

4840. NORMAND, D. Atlas des bois de la Côte d'Ivoire. Tome III. **[Atlas of timbers of the Ivory Coast. Vol. III.]** *Publ. Centre Tech. For. Trop.* No. 17, 1960. pp. 182 + 56 plates. [F.]

[Cf. *F.A.* 17 No. 3175.] Vol. III covers the families Bixaceae to Compositae, with chapters on the monocotyledons and the commercial timbers of the Ivory Coast and their identification. A list is given of timbers from the Ivory Coast kept at the Laboratoire d'Anatomie des Bois Tropicaux of the Centre Technique Forestier Tropical.

4841. **Specimen woods Nos. 292–4.** *Suppls.* to *Wood* 25 (4–6), 1960. Each pp. 2.

Blush Tulip Oak (*Tarrietia actinophylla*); Central American Cedar (*Cedrela mexicana*); and Broad-leaved Tea-tree (*Melaleuca leucadendron*).

4842. ARKWRIGHT, P. **Know your timber: Nos. 71–3.** *Woodwkg. Ind.* 17 (4–6), 1960 (211; 273; 323). P.R.

Alstonia (*A. scholaris*); Tawa (*Beilschmiedia tawa*); and Santa Maria (*Calophyllum calaba*).

4843. LAMB, G. N. **Foreign woods.** *Wood, Chicago* 65 (4), 1960 (18). P.R.

Australian Butt Maple (*Flindersia brayleyana*) and Ranai (*Alseodaphne semecarpifolia*).

4844. ***Parashorea malaanonan*** **(Blanco) Merr. Consignment No. 964.** Forest Products Research Laboratory, Princes Risborough. 1960. pp. 6. Limited distribution. P.R.

General description of timber; seasoning, mechanical and wood-bending properties; resistance to insect and fungal attack; natural durability; preservative treatment; working properties; veneer and plywood; and uses.

4845. KUKACHKA, B. F. **Foreign wood series. Mahogany (*Swietenia macrophylla* King).** *Rep. U.S. For. Prod. Lab., Madison* No. 2167, 1959. pp. 9 + 3 tbls. 8 refs. P.R.

Discusses nomenclature, the tree, and the wood, including its sp.gr., shrinkage characteristics, seasoning, machining properties, durability, mechanical properties, uses, and availability.

4846. **Properties of Australian timbers: Turpentine [*Syncarpia glomulifera*].** *For. Prod. Newslett. C.S.I.R.O. Aust.* No. 261, 1960 (4).

Habit and distribution, timber properties, seasoning, uses and availability of *S. glomulifera* (syn. *S. laurifolia*).

4847. **Properties of Australian timbers: Swamp Mahogany**. *For. Prod. Newslett. C.S.I.R.O. Aust.* No. 262, 1960 (4).

Briefly discusses the habit and distribution, timber, seasoning, uses, and availability of *Eucalyptus robusta* (syn. *E. multiflora*).

4848. **Properties of Australian timbers: Wandoo [*Eucalyptus wandoo*]**. *For. Prod. Newslett. C.S.I.R.O. Aust.* No. 260, 1960 (6).

Habit and distribution, timber properties, seasoning, uses and availability of *E. wandoo* (syn. *E. redunca* var. *elata*).

4849. STOYANOFF [STOJANOV], V., and ENTSCHEFF [ENČEV], E. *Populus przewalskii* und ihr Holz. **[*P. przewalskii* and its wood.]** *Repr. from Wissenschaftliche Zeitschrift der Technischen Hochschule Dresden* 8 (3), 1959 (580–4). 8 refs. [G.g.]

In Bulgaria, *P. przewalskii* has proved successful on most sites, including dry and calcareous ones, and up to 1400 m. alt., but not in flood-plains. It is fast growing, easy to propagate [cf. *F.A.* 20 No. 3110] and resistant to fungi and to the insects *Cossus cossus* and *Lithocolletis populifoliella*. Its beautiful crown makes it a useful roadside and park tree. Data are presented on density, shrinkage, and strength in compression, static bending and impact bending, based on samples from 3 trees aged 20 years. With a mean oven-dry density of ca. 0·45 g./c.c. its wood is heavier than that of other Poplars. Its strength exceeded that of Black Poplars and of local Pine.

4850. STOJANOV, V., and ENČEV, E. *Populus przewalskii* und ihr Holz. **[*P. przewalskii* and its wood.]** *C.R. Acad. Bulg. Sci.* 12 (6), 1959 (569–72). 1 ref. [G.russ.] E.M.B.

[Cf. preceding abstract.]

811. Structure, Identification

See also Nos. 4037, 4080, 4937.

4851. **Identification of hardwoods: a lens key.** *Bull. For. Prod. Res., Lond.* No. 25 (2nd ed.) 1960. pp. vi + 126 + 38 photos + 1 transparent scale (attached). 68 refs. Price 7*s.* 6*d.*

[Cf. *F.A.* 14 No. 616.] In this new edition the coded descriptions of the timbers have been revised and checked, 51 additional timbers included (covered by 13 extra descriptions) and 2 omitted. Where necessary, names have been changed to conform with British Standards Nos. 881 and 589 [see *F.A.* 17 No. 1906], and certain other textual alterations and corrections made. The bibliography has been expanded and brought up to date.

4852. GREGUSS, P. Holzanatomie der europäischen Laubhölzer und Sträucher. **[Wood anatomy of European dicotyledonous trees and shrubs.]** Akadémiai Kiadó, Budapest. 1959. pp. 330 + 307 plates + 6 tbls. 68 refs. [G.] Price [£7. 9*s.*]

[Cf. *F.A.* 11 No. 2735.] A revised and enlarged edition of the earlier work, including 50 additional species, mainly from the Mediterranean and the Caucasus.

4853. SAYA, I. Secondo contributo alla conoscenza del legno dei principali arbusti mediterranei. **[The wood of the principal Mediterranean shrubs. Part 2.]** *Ann. Accad. Ital. Sci. For.* 8, 1959 (309–26 + 3 plates). 21 refs. [It.]

[Cf. *F.A.* 19 No. 4732.] Describes, with photomicrographs, the wood of *Spartium junceum*, *Calycotome spinosa*, *Cytisus triflorus*, *C. monspessulanus*, and *C. scoparius*.

4854. MENON, P. K. B. **The wood anatomy of Malayan timbers: commercial timbers (continued). 3. Light hardwoods**. *Res. Pamphl. For. Res. Inst., Kepong* No. 27, 1959. pp. 30. Limited distribution.

[Cf. *F.A.* 17 No. 3192.] The following are dealt with: Bintangor (*Calophyllum* spp.), Durian (*Boschia griffithii*, *Coelostegia griffiithii*, *Durio* spp., and *Naesia altissima*), Jelutong (*Dyera costulata*), Geronggang (*Cratoxylon arborescens*), Kedondong (*Canarium* spp., *Dacryodes* spp., *Santiria* spp. and *Triomma malaccensis*), Kungkur (*Pithecellobium* spp.), Machang (*Mangifera* spp.), Medang (*Actinodaphne* spp., *Beilschmiedia* spp., *Cinnamomum* spp., *Cryptocarya* spp., *Dehaasia* spp., *Endiandra* spp., *Litsea* spp., *Nothophoebe* spp., and *Phoebe* spp.), Melunak (*Pentace* spp.), Mempisang (*Alphonsea* spp., *Cyathocalyx* spp., *Enicosanthum fuscum*, *Mezzettia leptopoda*, *Mitrephora maingayi*, *Monocarpia marginalis*, *Platymitra* sp., *Polyalthia* spp., *Sagaraea lanceolata*, *Trivalvaria nervosa* and *Xylopia* spp.), Light Red, Dark Red, White, and Yellow Meranti (*Shorea* spp.), Merawan (*Hopea* spp.), Mersawa (*Anisoptera* spp.), Nyatoh (*Ganua motleyana* var. *latifolia*, *Palaquium* spp., and *Payena* spp.), Pulai (*Alstonia* spp.), Ramin (*Gonystylus* spp.), Sepetir (*Sindora* spp.), Sesendok (*Endospermum malaccense*), Terap (*Artocarpus* spp., and *Parartocarpus triandra*), Terentang (*Campnosperma* spp.). There is also information (supplementary to a previous publication) on some heavy hardwoods: Kekatong (*Cynometra* spp.), Mengkulang (*Tarrietia* spp.), and Merpauh (*Swintonia* spp.).

4855. WILSON, T. K. **The comparative morphology of the Canellaceae**. **I. Synopsis of genera and wood anatomy**. *Trop. Woods* No. 112, 1960 (1–27 + 3 plates). 55 refs.

The author considers the Canellaceae to be composed of 6 genera: *Canella*, *Pleodendron*, *Cinnamodendron*, *Capiscodendron*, *Warburgia*, and *Cinnamosma* and, after studying their xylem, compares the Canellaceae with members of the Parietales and Ranales, orders in which this family is placed in many taxonomic systems. While the rays show some fairly advanced features, other features point to a low level of specialization not in accord with the high rank given to this family in most systems of classification. The wood of the Canellaceae has greater similarity to that of the woody Ranales (especially to that of Eupteleaceae, Dilleniaceae, Eupomatiaceae, Illiciaceae, and Schisandraceae) than to that of the woody Parietales. *From author's summary.*

4856. CARLQUIST, S. **Wood anatomy of Cichorieae (Compositae).** *Trop. Woods* No. 112, 1960 (65–91 + 6 plates). 30 refs.

Describes and discusses the anatomy of the 14 woody species of Cichorieae, with a tabular key to anatomical characters.

4857. BRIZICKY, G. K. **A new species of *Paramachaerium* from Panama.** *Trop. Woods* No. 112, 1960 (58–64 + 2 photos). 3 refs.

Gives botanical and anatomical descriptions of a new species, *P. gruberi*, based on an examination of leafy twigs, flowers, and fruits collected from the same individual. Because the structure of the wood samples suggested that of *Swartzia*, they had previously been identified tentatively as belonging to that genus [see *F.A.* 20 No. 2841].

811.1. Anatomical Elements and Tissues

See also No. 4945.

4858. BOSSHARD, H. H. Holzstruktur und Holzbearbeitung. **[Wood structure and woodworking.]** *Repr.* from *Revue, Schweizer Maschinenmarkt, Goldach* 1960 (1). pp. 12. 14 refs. [G.] X.

Discusses, with photomicrographs, the differences in structure between e.g. softwoods and hardwoods, tropical and temperate species, and within a species between e.g. late and early wood, and the effect of growth factors on structure. Reviews work by various authors on the effect of structure on cutting force, blunting of tools, and quality of the surfaces, and on bending properties.

4859. RICHARDSON, S. D. **The effect of night temperature on tracheid size and wood density in conifers.** *News Bull. Int. Ass. Wood Anatomists* 1959 (2), (4).

Abstract of a paper prepared for the International Botanical Congress, Montreal. In seedlings of Douglas Fir, *Sequoia sempervirens* and Sitka Spruce, grown under a range of different day and night temperatures, in a controlled environment, wood density and cell-wall thickness increased with temperature, but revealed no consistent relation with day temperature or rate of growth. Tracheid length increased with temperatures, night or day. It is suggested that cell elongation is a relatively direct function of temperature, while cell-wall thickness is determined by net assimilation rate. A hypothesis, based on observed changes in net assimilation rate with age, is proposed to account for differences in density between so-called juvenile and adult wood.

4860. HEJNOWICZ, A., and HEJNOWICZ, Z. **Variations in length of vessel members and fibres in the trunk of *Robinia pseudoacacia*.** *Acta Soc. Bot. Polon.* 28 (3), 1959 (453–60). 5 refs. [E.e.] O.B.D.

The length of fibres and vessel members was studied in ca. 700 samples taken from different parts of the stem and different parts of the growth ring in a 36-year-old *Robinia pseudoacacia*. A small increase in vessel length was found with increasing distance from the pith, but within the same growth ring the length did not vary. A distinct change was found in fibre length within the same growth ring. The shortest fibres were found in the first growth layers, in the part of the ring having the large vessels of early wood. The maximum length was found in the middle of the ring and remained more or less constant until it dropped somewhat in the outermost layers of the late wood. With increasing distance from the pith, the length of fibres in the first-formed early wood remained unchanged, whereas in the other layers of the growth ring there was a distinct increase in length from the pith outwards. Consequently the range of variation within the ring increased slightly from the pith outwards. The variation in fibre length in the storeyed wood of *Robinia* is due to the change in degree of intrusive growth of the fibres during their differentiation.

4861. [LOACH, A. M.] **The duration of the juvenile period in the wood of Grenadier Apple trees, as indicated by fibre and vessel member length.** *Extr.* from *Rep. Imp. For. Inst., Oxf. 1958/59*, 1959 (19).

Fibre length was investigated in two stems of Apple from the same clone, grafted on to vigorous and dwarfing stocks respectively, using one tree of each and two discs at different heights from each tree. Within the growth ring, fibre length increased to a maximum in the middle of the ring; comparison with the length of the vessel members suggested that this was primarily due to intrusive growth of the fibres. In both trees increase in fibre length outwards, at any level, appeared to be more closely related to distance, than to number of rings, from the pith.

4862. GODAVARI, C. P. **On the anatomy of the seedlings of *Araucaria bidwillii* Hook. and *Agathis brownii* L. H. Bailey.** *Curr. Sci.* 29 (3), 1960 (107–8). 3 refs. A.P.B.

Wood of seedlings of both species showed well spaced uniseriate pits in the initial stages. In the later-formed tracheids also a few pits were found, tending towards contiguity and flattening. It is thought that this tendency is the first step towards multiseriate pitting in the mature wood, i.e. that this character of the mature wood is secondarily derived.

4863. CRONSHAW, J. **The fine structure of the pits of *Eucalyptus regnans* (F. Muell.) and their relation to the movement of liquids into the wood.** *Aust. J. Bot.* 8 (1), 1960 (51–7 + 8 plates). 18 refs. O.B.D.

Presents the results of a study of the detailed structure of the pit borders and the pit closing membranes by means of electron-microscope observations of carbon replicas. In all cases (vessels, ray parenchyma cells, fibres and tracheids) in the mature wood, the primary wall is left, apparently without modification, as the pit membrane. In the vessels the pit borders are not separate; the cellulose microfibrils of a border may be common to several pits. The pit borders of fibre tracheids and tracheids are developed as separate entities, and have a structure similar to the pit borders of softwood tracheids. The structure of the secondary wall layers associated with the pits is described and related to the structure of the pits. The fine structural features of the pits, especially of the pit closing membranes, are discussed in relation to the movement of liquids in wood. *From author's summary.*

4864. [STEVENS, S. H. I.] **Tracheid length in *Pinus caribaea* Morelet**. *Extr.* from *Rep. Imp. For. Inst., Oxf. 1958/59*, 1959 (18–9).

A study was made of material from British Honduras. Variation within the growth ring was investigated in connexion with sampling. Although, in general, tracheid length was greatest in the late wood, there were so many inexplicable variations that it was considered better to take a mixed sample from a whole ring. Increase in tracheid length from the pith outward was more closely related to distance than to number of rings from the pith.

4865. JACQUIOT, C. Structure anatomique et chimique des organes végétaux utilisés par l'industrie de la cellulose. [**Anatomical and chemical structure of the vegetable substances used in the pulping industry**.] *Repr.* from *Bulletin, Association Technique de l'Industrie Papetière, Paris* 1958 (1). pp. [6] + 14 photomicrographs. [F.f.] P.R.

A brief study of the anatomical structure of 3 coniferous and 9 hardwood species [data tabulated for each], giving the biometric characteristics of different fibres and the relative volumes of the different types of tissue, with particular reference to their significance in pulping.

4866. DADSWELL, H. E., and WARDROP, A. B. **Some aspects of wood anatomy in relation to pulping quality and to tree breeding**. *APPITA, Melbourne* 13 (5), 1960 (161–73). 27 refs.

[Cf. *F.A.* 20 No. 5320.] Discusses the part that anatomical investigations may play in the assessment of trees for breeding purposes. The relationships between anatomical features and wood properties are pointed out for both hardwoods and softwoods. Fibre volume and fibre length are considered to be the most significant criteria for good pulpwood species. The inheritance of structural features in certain papermaking species is discussed. *From authors' summary.*

4867. BOYCE, S. G., and KAEISER, M. **Small increment cores can be used for sampling Cottonwood fibers**. *J. For.* 58 (6), 1960 (484–5). 3 refs.

It was found that mean fibre length in *Populus deltoides* can be accurately determined from small increment cores (5·2 mm. diameter). Measurements were the same from these small cores as from large cores or wedge-shaped sections. The method is rapid and easy, does little damage to trees, and can be applied to species where the maximum length of the fibre does not exceed 2 mm.

4868. SCARAMUZZI, G. Indagini tecnologiche sul legno di alcuni ibridi euramericani di pioppo. II. Dati anatomici. [**Technological investigations on the wood of some hybrid Poplars [*Populus* × '*canadensis*']. II. Anatomical data**.] *Pubbl. Cent. Sper. Agric. For., Roma* No. 3, 1959 (1960), (193–216 + 2 plates). 38 refs. [It.it.*e.e.*]

The investigations already made on clone 'I. 214' [cf. *F.A.* 21 No. 2288] have been extended to three other clones ('I. 154', 'I. 455', and I. 488 b').

811.2. Special Features and Abnormal Structure

See also Nos. 4030, 4421–2, 5095.

4869. WARDROP, A. B. **Scientific review: the structure and formation of reaction wood in Angiosperms**. *News Bull. Int. Ass. Wood Anatomists* 1960 (1), (2–8). 23 refs.

4870. BERLYN, G. P. **A biometric technique for reaction tissue research**. *Repr.* from *Proc. Iowa Acad. Sci.* 66, 1959 (98–102). 4 refs.

Images of sections of tissue taken from the upper side of leaning stems of *Populus deltoides* were projected on a paper grid system. Specimens were oriented so that the cambium and the last three annual increments were included in cross-section. Counts of stimulated and non-stimulated cells in randomly selected grids were recorded. This procedure provides a means of subjecting the incidence of tension wood and other cytohistological phenomena to statistical analysis. *Author's abstract.*

4871. MURTHY, L. S. V. **Radial strands of phloem in the xylem of *Dactylocladus stenostachys* Oliv**. *Extr.* from *Rep. Imp. For. Inst., Oxf. 1958/59*, 1959 (19).

A study was made of the small flecks or holes that form a characteristic defect in Jongkong timber. These proved to be radial strands of included phloem. Similar strands running axially are characteristic of some genera in this family, the Melastomaceae, but radial strands do not appear to have been recorded before. Seedling material showed that these strands originate a few cells out from the pith, from which they are separated by a zone of stone cells.

811.4. Growth Rings. Early and Late Wood

4872. LARSON, P. R. **A physiological consideration of the springwood summerwood transition in Red Pine [*Pinus resinosa*]**. *For. Sci.* 6 (2), 1960 (110–22). 32 refs.

To test the hypothesis that late wood (l.w.) formation may be correlated with the cessation of terminal elongation (t.e.) and the setting of new buds through an auxin-mediated system [cf. *F.A.* 19 No. 4741], an investigation was made to determine: (1) the relationship between the cessation of t.e. and the transition of early wood (e.w.) to l.w. and (2) the effect on growth-ring formation of exogenous applications of a growth regulator to decapitated seedlings. In the experiments made, *P. resinosa* seedlings grown (*a*) under long-day (18 hr.) conditions, at 72° F. (day) and 62° (night), continued to produce e.w.-like cells for an extended period, while the formation of l.w.-like cells could be induced by (*b*) either short-day (8 hr.) treatment or decapitation. E.w.-like cell production was resumed after transfer of seedlings with intact buds from (*b*) to (*a*), and limited production of e.w.-like cells was induced in decapitated, short-day seedlings by the exogenous application of IAA. The original hypothesis is re-stated in more specific terms in the light of the experimental evidence obtained. The extent to which a change in terminal activity registers an accompanying change in xylem tracheid development is thought to depend on the intensity of the apical stimulus. Thus, a false ring originating from a "second flush" of growth may be evident only in the uppermost parts of the stem. The increase in l.w. cell-wall thickness is due to a different physiological process from that causing the decrease in cell diameter, although the two phenomena occur roughly simultaneously in normal l.w. development.

811.5. Sapwood and Heartwood

4873. NEČESANÝ, V. **Change of vitality of parenchyma cells as a physiological basis of heartwood formation.** *News Bull. Int. Ass. Wood Anatomists* 1959 (2), (2–4).

Abstract of a paper prepared for the International Botanical Congress, Montreal. In *Fagus sylvatica*, *Acer platanoides*, *Tilia platyphyllos*, *Quercus robur*, *Ulmus effusa*, and *Pinus sylvestris*, vitality (deduced from osmotic values) decreased in sapwood from the cambium inwards. Values were higher close to false heartwood (*a*) than close to true heartwood (*b*), where they approached zero. It is concluded that (*b*) is largely formed by the death of parenchyma cells by ageing, and (*a*) by their death through frost, drought, fungi etc. [Cf. *F.A.* 20 No. 2273.]

4874. NEČESANÝ, V. Jádro buku. Struktura, vznik a vývoj. **[Beech heartwood—structure, origin and development.]** Vydavatel'stvo Slovenskiej Akadémie Vied, Bratislava. 1958. pp. 231 + 65 photos. 171 refs. [Cz.russ.g.] P.R.

The book contains chapters on: macroscopic structure, terminology, microscopic structure, chemical composition, physiological functions, origin and development, nature and classification from a biological standpoint. Each chapter is summarized in the 9-page German summary. The book also contains a glossary of 54 Czech terms referring to Beech heartwood, and the equivalents of some or all of the terms in Slovakian, German, Russian, Polish, Croatian, Slovenian, Macedonian, Bulgarian, Albanian, Hungarian, Danish, Swedish, English and French.

811.6. Texture, Grain, Figure

See also No. 4946.

4875. NEWALL, R. J. **Bark form and veneer figure in home-grown Birch.** *Wood* 25 (5), 1960 (196–200).

Betula verrucosa and *B. pubescens*, about 50 years old, some with smooth and others with rough bark, were peeled and sliced into veneer, 0·032 in. thick, to investigate a possible association between bark conformation and grain, particularly that known as flamy figure. Rough bark was usually associated with figured or distorted grain, smooth bark with straight grain. Six types of figure were encountered: snail, catspaw, blister, flash, wrinkle and flame. Flamy figure results from grain that has waves in both the radial and tangential directions. The crests of waves seen on a radial section were inclined at an angle to the tree's axis in a downward direction from pith to bark; on a tangential section the crests were more nearly at right angles to the axis. No precise connexion could be established between flamy figure and bark; it appeared to have some association with bark having wide, deep, fairly continuous fissures, though external differences between trees containing flamy grain and other trees may be apparent only in trees much older than the sample studied. There may be some connexion between the occurrence of flamy figure and butt development; the figure was rarely found at > 6 ft. up the tree, and it occurred on the edges of buttresses regardless of bark type. *From author's summary.*

4876. TAUCHNITZ, E. Über Rindentypen und Furnierqualitäten der Birke im Süden der Deutschen Demokratischen Republik. **[Bark types and veneer quality in Birch in the south of Eastern Germany.]** *Forst u. Jagd* 10 (4), 1960 (181–5). 12 refs. [G.]

Extract from a thesis, based on 1447 *Betula verrucosa* on 18 sites in Thuringia and Saxony. Bark types appeared to be largely hereditary, showing little correlation with site or even with age or diameter. Though no sure guides to wavy or patterned grain, they proved an important diagnostic tool when combined with an examination of chips from the undercut. The existence in the area of trees with these valuable grain patterns was established. [Cf. *F.A.* 17 No. 3652.]

811.7. Phloem; Bark

See Nos. 4875–6.

812. Physical and Mechanical Properties

See also Nos. 4419–20, 4836.

4877. FREIDIN [FREJDIN], A. S. **Effect of radioactive radiation on the physical and mechanical properties of wood.** *Transl. Commonw. Sci. Industr. Res. Organ. Aust.* No. 4417, 1959. pp. 7 + 6 gphs. 8 refs. Transl. by R. J. Zatorski from *Derev. Prom.* 7 (9), 1958 (13–5). [See *F.A.* 20 No. 3696.] Limited distribution.

4878. PAUL, B. H., DOHR, A. W., and DROW, J. T. **Some physical and mechanical properties of Noble Fir [*Abies procera*].** *Rep. U.S. For. Prod. Lab., Madison* No. 2168, 1959. pp. 14 + 1 dgm., 17 gphs., 8 tbls. P.R.

Presents data, based on a study of 2800 wood specimens cut from 15 trees from Washington and Oregon, indicating values for sp.gr., and radial, tangential, and longitudinal shrinkage, and results of tests on toughness and compression ||. Some data from earlier studies (9 trees cut in 1913 and 1918 at 3000–3500 ft. in Oregon) are included.

4879. PAUL, B. H., DOHR, A. W., and DROW, J. T. **Some properties of California White Oak and Oregon White Oak.** *Rep. U.S. For. Prod. Lab., Madison* No. 2135, 1958. pp. 8 + 4 tbls., 1 gph., 2 photos. 3 refs. P.R.

Examination of a few short sections from variable tree heights, plus a limited number of tests, showed the clear wood of both *Quercus lobata* and *Q.*

garryana to have strength properties closely approaching those of *Q. alba*. If the present samples can be taken as representative of commercially available material, the many knots and the presence of tension wood could be expected to restrict the production of high-grade timber. Besides its influence on strength properties, the occurrence of tension wood would be likely to cause excessive shrinkage and warping in seasoning.

4880. CURRÒ, P. Indagini tecnologiche sul legno di alcuni ibridi euramericani di pioppo. I. Caratteristiche fisiche e meccaniche. **[Technological investigations on the wood of some hybrid Poplars. I. Physical and mechanical characteristics.]** *Pubbl. Cent. Sper. Agric. For., Roma* No. 3, 1959 (1960), (3–59). 7 refs. [It.it.e.*e*.]

Variations in moisture content, basic density, oven-dry density, and radial and longitudinal shrinkage were studied in the following clones of *Populus* × *euramericana* [*P.* × '*canadensis*']: 'I.154' (4 trees), 'I.214' (2), 'I.455' (8), and 'I.488' (2). Values of m.c. were highest near the pith, decreasing towards the bark, but the outermost annual ring generally showed a slightly higher m.c. than the immediately preceding ring or rings. Mean m.c. decreased from the ground upwards. M.c. was higher in winter-felled trees. Basic density and oven-dry density increased from the pith to the bark and from butt to top. With the exception of clone 'I.154', axial, radial, tangential, and volumetric shrinkage decreased from butt to top. The relation of sp.gr. to m.c. was studied both by using diagrams that show sp.gr. values at different m.c.'s for a given shrinkage coefficient, and by subjecting samples to conditioning in a climatic cell. The relation of compression strength to m.c. was investigated by conditioning samples of the same sp.gr. for 48 hours in different humidity conditions, and subsequently subjecting them to compression. All test data are given in tables and diagrams with English as well as Italian legends.

4881. JAPING, H. W. Gegevens van proeven over de belangrijkste mechanische en fysische eigenschappen van 5 bekende Surinaamse houtsoorten, in vergelijking met die van vroeger onderzochte 41 minder bekende soorten. **[Data from tests on the most important mechanical and physical properties of 5 well known Surinam timbers, compared with those from 41 lesser known ones tested earlier.]** *Meded. Inst. Trop. Amst.* No. 136 (*Afd. Trop. Prod.* No. 51), 1960. pp. 57. [Du.E.]

The species tested were *Ocotea rubra*, *Dicorynia paraensis* or *Dicorynia* spp., *Goupia glabra*, *Diplotropis guianensis* or *Diplotropis* spp., and *Simaruba amara*. Detailed tabulated results are given and values are compared with those from an earlier test [see *F.A.* 19 No. 2269].

812.1. Optical, Acoustic, Frictional, Thermal and Electrical Properties

See also Nos. 4900, 4975, 4981–3, 4999, 5004, 5012, 5045.

4882. Anföranden vid symposium om träets exoterma egenskaper vid Svenska Träforskningsinstitutet, Trätekniska avdelningen, den 15 Oktober 1959. **[Papers from a symposium on the exothermic properties of wood, at the Swedish Forest Products Research Institute, Wood Technology Section, 15 Oct. 1959.]** *Svensk PappTidn.* 63 (7), 1960 (225 . . . 236). [Sw.] P.R.

Reproduces the following papers: Ignition of wood at temperatures below the normal ignition point (*B. Östlin*; 10 refs.) [cites some recent Swedish examples of fires following prolonged contact of solid wood, shavings, etc., with pipes carrying heated water or steam; with temperatures generally in the range 100–120° C.]; Fire safety tests for fibreboard (*O. Brauns*) [summarizing discussions on test methods by the FAO Wood Technology Committee, especially those of its 1958 meeting cf. *F.A.* 20 No. 3737]; Current methods of testing fire [resistance] at the [Swedish] Statens Provnings-anstalt (*A. Mårtenson*) [with illustrations of equipment and techniques].

4883. **Fire-test methods used in research at the Forest Products Laboratory**. *Rep. U.S. For. Prod. Lab., Madison* No. 1443 (rev.) 1959. pp. 22 + 20 photos, 1 drawing, 1 dgm., 5 gphs., 10 tbls., and 2 sample data sheets. 17 refs. P.R.

[Cf. *F.A.* 15 No. 4033.] Further data on the 9 flame-spread and 2 flame-penetration test methods described, with additional tables, photos and bibliographical information.

4884. KOLLMANN, F. Vergleichende Prüfungen des Brandgeschehens bei Holz und Holzwerkstoffen im unbehandelten und imprägnierten Zustand mittels verschiedener Kleingeräte. **[Comparative tests of the combustion process in untreated and impregnated wood and wood products, using various small-scale types of apparatus.]** *Svensk PappTidn.* 63 (7), 1960 (208–17). 10 refs. [G.g.sw.e.] P.R.

The six methods tested in 270 tests, with some 8000 separate measurements, were: (1) the Truax-Harrison fire-tube test; (2) Seekamp's weight-loss method [see *F.A.* 16 No. 2616]; (3) the 'chimney-stack' method described in DIN 4102 [cf. *F.A.* 19 No. 4923]; (4) Brauns' fire-chamber method [see *F.A.* 19 No. 2274]; (5) an English auxiliary method, using an electric heating coil in which measurements are made of weight-loss/time, temperature of the side of the panel nearest to the source of heat, and the length of the charred stretch; and (6) the inclined panel test, described in *Brit. Stand.* No. *BS* 476. Of these, (4) and (3) gave the most satisfactory results.

4885. SMITH, L. W. **Heat sensitivity of the skin to wood and other materials**. *For. Prod. J.* 10 (3), 1960 (170).

A discussion of the various factors involved, with special reference to a formula developed by W. F. Roeser of the U.S. National Bureau of Standards, involving heat capacity, density, and thermal conductivity of both the skin and the material handled, with a table of thermal constants and calculated sensitivity for Oak, Douglas-Fir, aluminium, iron, and concrete.

4886. PETERSON, R. W. **The dielectric properties of wood.** *F.P.L. tech. Note For. Prod. Lab. Can.* No. 16, 1960. pp. 22.

Extensive tests on Yellow Birch and Douglas Fir, with some supplementary tests on Sugar Maple and White Spruce, suggested a marked relationship between dielectric constant (K) and density, K increasing with density, regardless of species. The same general trend, though less clearly marked, was observed for the power factor. Further studies were made with the aim of relating dielectric properties to wood density rather than species, wood of 6 species (White Oak, Black Cherry, Jack Pine, Basswood, Eastern White Cedar, and Balsam) being used to provide a wide range of densities. Though, for any one density, there was marked grouping of experimental results by species, the results as a whole showed that K was dependent on density, regardless of species. For oven-dry wood this relationship was a straight line, its equation being approximately $K = 0{\cdot}031\ d + 0{\cdot}956$, where d is density in lb./cu. ft. For other moisture contents the curve was exponential, its slope increasing with density. Results also indicated a slight correlation, less marked than that for K, between the power factor and density.

4887. UYEMURA, T. **[Dielectrical properties of woods as the indicator of moisture.]** *Bull. For. Exp. Sta., Meguro, Tokyo* No. 119, 1960 (95–172). 57 refs. [Jap.e.*e*.]

Examines the dielectric properties of 39 Japanese species, with detailed descriptions of the measurement methods and apparatus used. The main factors affecting measurement of moisture content are studied, and graphs [with English legends] showing the relationships between the dielectric constant and the m.c. of woods are presented.

812.2. Behaviour with Liquids and Gases. Moisture Relations etc.

See also Nos. 4030, 4863, 4886–7, 5015, 5079, 5097.

4888. VAKIN, A. T. K metodike opredelenija vlažnosti neprosušennoj drevesiny. **[A method of determining the moisture content of green wood.]** *Lesn. Ž., Arhangel'sk* 2 (1), 1959 (126–31). 9 refs. [Russ.]

[Cf. *F.A.* 21 No. 2305.] Discusses the results of m.c. measurements made in 1933–34, and now published for the first time, on stacked Spruce logs, using sapwood samples extracted (*a*) by a 6-mm. Pressler borer, and (*b*) by a chisel or saw. Comparison of the m.c. of samples (*a*) and (*b*) showed that (*a*) gave underestimates at low wood m.c.'s, and overestimates at very high ones. When the wood m.c. was near the fibre-saturation point, the error was insignificant. At wood m.c.'s of 40–60%, the borer squeezed out moisture equal to ca. 10% of the oven-dry weight of the wood, and at 100–140% m.c., it squeezed out 34–48%. At wood m.c.'s $> 200\%$, moisture was sucked into the sample. It is suggested that the error may vary with borer diameter and with the sharpness of the cutting edge. The % corrections to be applied to m.c.'s measured from cores are tabulated for wood m.c.'s of 21 to 240% (20% intervals).

4889. OHNUMA, K., and SAITO, H. **Some aspects of the effect of temperature upon the shrinkage of wood.** *Transl. For. Prod. Lab. Can.* No. 134, 1959. pp. 8. 13 refs. *Transl.* from *Bull. For. Exp. Sta., Meguro, Tokyo* No. 116, 1959 (75–84). [See *F.A.* 21 No. 2312.] Limited distribution.

4890. KRPAN, J. Utezanje i krivulja sušenija bukovine. **[Shrinkage and the drying curve of Beech.]** *Drvna Ind.* 11 (3/4), 1960 (53–4). [Croat. e.] P.R.

Using the British F.P.R.L. Schedule No. 4, 210 Beech boards (25·2–30 mm. thick; 12–30·8 cm. wide; 1·68–1·85 m. long) were dried from 69·2 to 6·2% m.c. in 141·5 hours. Shrinkage values were: volume 14·8, width 7·6, and thickness 6·3%. The drying curve was exponential.

4891. SADOH, T. **[The effects of moisture content upon the rate of moisture adsorption by hemicellulose.]** *J. Jap. Wood Res. Soc.* 6 (2), 1960 (45–8). 3 refs. [Jap.e.*e*.] P.R.

Investigates the rates of moisture adsorption by isolated *Fagus crenata* hemicellulose at various m.c.'s and temperatures, and presents graphical data showing the adsorption processes in the form of curves for m.c. vs. logarithm of time, the inflection point on the curves being used as an index of sorption rate.

4892. DOSTAL, E. J., MARRACCINI, L. M., and KLEINERT, T. N. **Sorption phenomena: their influence in the rapid forced penetration of dilute alkali into wood.** *Pulp Paper Mag. Can.* 61 (Convention No.), 1960 (168–73). 28 refs.

From studies of alkali sorption on comminuted wood, and of rapid forced penetration of dilute alkali into wood, it is concluded that alkali sorption in the outer layers of the wood has a bearing on the alkali distribution within the wood. This applies for penetration in the three structural directions. In the grain direction, penetration resembles liquid flow into capillaries. Results indicate that oblong pieces of wood (ca. $\frac{1}{10}$ in. thick and ca. 1 in. long) can be rapidly and almost uniformly penetrated by alkaline liquors, especially if treated in a phase mixture of high turbulence. Comminuted wood of similar shape and size, and thus alkali-penetrated, would be a most suitable starting material for rapid alkaline pulping operations.

4893. DOSTAL, E. J., MARRACCINI, L. M., and KLEINERT, T. N. **Rapid forced penetration of dilute alkali into wood.** *Holzforschung, Berlin* 14 (1), 1960 (21–5). 24 refs. [E.e.g.] P.R.

Substantially the same as work already noticed [see preceding abstract].

4894. TARKOW, H., and STAMM, A. J. **Diffusion through air-filled capillaries of softwoods—Part I: Carbon dioxide.** *For. Prod. J.* 10 (5), 1960 (247–50). 3 refs.

Since CO_2, unlike water vapour, diffuses only through the air-filled capillaries in wood and not through the wood substance, its diffusion rate through dry Sitka Spruce was used to test experimentally Stamm's calculations [cf. *F.A.* 9 No. 301] relating to vapour diffusion in the capillaries.

While, in the fibre direction, the diffusion coefficient calculated on an experimental basis was ca. one-half the theoretically computed value, it was only ca. $\frac{1}{30}$ thereof in the tangential direction (ca. $7{\cdot}4 \times 10^{-5}$ vs. $2{\cdot}3 \times 10^{-3}$ sq. cm./sec.). This is thought to indicate that the theoretical assumption of free bulk diffusion holds good for the passage of the gas through the fibre cavities and pit chambers but not through the pit-membrane pores, whose effective size is smaller than the mean free path of the gas under atmospheric pressure and would present ca. 40 times as much resistance to the passage of gas molecules as the resistance under free diffusion conditions.

812.3. Density. Specific Gravity. Buoyancy

See also Nos. 4487, 4859, 4886, 4918, 4939, 4944–5, 5094.

4895. McKimmy, M. D. **Factors related to variation of specific gravity in young-growth Douglas Fir.** *Bull. Ore. For. Prod. Res. Cent.* No. 8, 1959. pp. 52. 62 refs.

A study based on 36 trees aged < 160 years, representing 4 crown classes, from 8 sites of 3 site classes in Oregon and Washington. Interrelationships were highly complex, and variations great. Site class, crown class, and geographical location appeared to have little effect on sp.gr. (measured as basic density). Sp.gr. tended to increase with age from pith, % of late wood, and, less consistently, with number of growth rings per in. The combined effect of late-wood % and growth rate increased with height level. It was not sufficient to permit reliable predictions of sp.gr. Strength properties were similar to those established for old-growth Douglas Fir, and were closely related to sp.gr.

4896. Göhre, K. Die Verteilung von Rohwichte im Pappelstamm. **[The distribution of density in Poplar stems.]** *Wiss. Abh. Dtsch. Akad. LandwWiss., Berl.* No. 44 (*Beitr. Pappelforsch.* No. 4), 1960 (51–79). 13 refs. [G.g.russ.e.]

An investigation based on nearly 10,000 samples from 8 *Populus* × *marilandica* and 10 *P.* × *regenerata* aged 20–24 years growing on 3 sites. Density patterns in the stem were rather complex, but generally there was a central cone of heavy wood at the base, surrounded first by lighter and then by heavier wood in the lower part of the stem. In the crown region, the wood was heavy at the centre of the stem and sometimes throughout the cross-section, so that the mean density in the top part of the stem was greater than near the base. Variations within and between trees were too great to establish correlations with site, but for both varieties the mean density was greatest on a dry spoil-mound. Mean density of *P.* × *marilandica* was greater than that of *P.* × *regenerata*. Density was correlated with the number of fibres per unit area of cross-section, and with % of reaction wood, but neither with ring width nor with thickness of cell-wall.

4897. [Murthy, L. S. V.] **Density variation in the timber of Ramin, *Gonystylus bancanus*.** *Extr.* from *Rep. Imp. For. Inst., Oxf. 1958/59*, 1959 (19).

Wood samples were studied from 20 trees representing 3 sites in Sarawak. The material was remarkably similar in density at 1 in. from the pith but, whereas the material from the Padang and deltaic mixed swamp showed a marked increase outwards, the large trees from the coastal swamp (which supply the commercial timber) remained stable at a lower density. The woods with the lowest density rather surprisingly showed a high % of fibres. Though the relative proportions of rays and parenchyma varied considerably, the total of the two tissues tended to remain relatively constant from the pith outwards on each site.

812.7. Strength Properties

See also Nos. 4933, 4939, 4986, 5003–5, 5010–1, 5026.

4898. Sekhar, A. C., and Negi, G. S. **A note on coefficients of variation for mechanical properties of woods.** *Repr.* from *Journal of the National Buildings Organisation, India* 4 (2), 1959 (27–30). 8 refs. P.R.

Explains some applications of the coefficient (c.v.), e.g. in providing an appropriate standard deviation within the limits of which a definite % value for a particular mechanical property of the material will lie, and stresses the desirability of determining what number of sample trees will give a desired c.v. for all properties and all species. To this end the mean, min. and max. c.v.'s are tabulated for the different properties for 50 Indian species of widely differing specific gravity and localities, based on 5 representative trees of each. The data are compared with U.S. and Australian values and discussed.

4899. Sekhar, A. C., and Bhartari, R. K. **Studies on strength of Bamboos: a note on its mechanical behaviour.** *Indian For.* 86 (5), 1960 (296–301). 10 refs.

Gives tabulated data from tests on *Dendrocalamus strictus*, *Bambusa nutans*, *B. spinosa*, and *Phyllostachys edulis*: characters tested were sp.gr., static bending, impact bending, and crushing, shear, and tensile strength.

4900. Kollmann, F., and Krech, H. Dynamische Messung der elastischen Holzeigenschaften und der Dämpfung. **[Dynamic measurement of elastic properties of wood, and of damping.]** *Holz Roh- u. Werkstoff* 18 (2), 1960 (41–54). 23 refs. [G.g.e.] P.R.

Discusses the theory underlying the determination of elastic wood constants and the damping capacity of wood by employing dynamic methods based on the measurement of natural vibrational frequency [cf. *F.A.* 19 No. 4781; 20 No. 3702]. Using Spruce and Oak, tests were made of: (1) the dependence on density of the moduli of elasticity (E) and shear (S), the velocity of sound, and logarithmic decrement; (2) the comparability of static and dynamic methods; and (3) the dependence of elasticity and damping capacity (D) on moisture content. In (1) it appeared that S was less dependent on density than was E, while D was not influenced by density at all. In (2), E moduli determined in static bending tests were, after correction for the shearing force influence, ca. 4% lower than those determined by vibrational tests. In (3), a sharp decrease in the decrement took place in the chemosorption range, while an increase in m.c. up to the fibre saturation point caused an increase in *D*. Results showed that the increase in damping with increasing bending frequency was due to the influence of shearing stresses. *From authors' summary.*

4901. Ivanov, Yu. [Ju.] M. **High elastic deformation of wood.** *Comp. Wood* 5 (4), 1958 (51–6). 5 refs. P.R.

Essentially the same as an earlier paper in Russian [see *F.A.* 21 No. 2321].

4902. Clouser, W. S. **Creep of small wood beams under constant bending load.** *Rep. U.S. For. Prod. Lab., Madison* No. 2150, 1959. pp. 25 + 2 photos, 17 gphs., 1 tbl. 64 refs. P.R.

Presents results of tests on small Douglas-Fir beams, performed under constant temperature and r.h. conditions (maintaining the specimens at 6 or 12% equilibrium m.c. for periods $\leqslant$ 10 years), with constant loads applied until failure. The behaviour of the specimens is analysed for such factors as the amount and rate of deflection, and their effective life, results being given in terms of stress level, power-law equation constants, creep rate, and time.

4903. Krech, H. Grösse und zeitlicher Ablauf von Kraft und Durchbiegung beim Schlagbiegeversuch an Holz und ihr Zusammenhang mit der Bruchschlagarbeit. **[Magnitude and time characteristics of force and deflection in impact bending tests on wood, and their relation to the work done to failure.]** *Holz Roh- u. Werkstoff* 18 (3), 1960 (95–105). 18 refs. [G.g.e.] P.R.

Describes an experimental rig for impact bending tests, in which the pattern of force and deflection can be recorded. Tests were made on Silver Fir, Ash, Beech, Hickory and laminated timber to determine the influence of (1) wood density, (2) wood moisture content, (3) impact velocity, and (4) span width, on (5) work done to failure, (6) bending strength, (7) deflection, and (8) duration of stress. While (6) increases virtually in proportion to (1), (5) increases with a higher power of (1). The influence of (5) on (7) and (8) depends on the toughness of the wood. Increasing (2) causes a decrease in (6) and an increase in (7). Within the range investigated, (5) was independent of (2), and (4) appeared to have no influence on (6). The influence of (3) on the results was significant. It was found that (7) increased continuously up to fracture, and that the different values of (5) for different species of comparable density were not due to differences in (6) but to different magnitudes of (7). The tougher the wood, the greater the deformation sustained without fracture, and the more the energy absorbed after incipient failure. *From author's summary.*

4904. Jonaitis, S. Juodalksnio medienos fizinių-mechaninių savybių nustatymas lauko sąlygomis. **[Determining the physical and mechanical properties of *Alnus glutinosa* wood in the field.]** *Liet. Miškų Ūkio Moksl. Tyr. Inst. Darb.* No. 3, 1958 (263–9). 8 refs. [Lith.russ.]

Describes a special gun which presses a steel ball (25·4 mm. diam.) into wood with a constant force of 14·2 kg. This is used for measuring wood hardness (H) under field conditions, by applying the formula $H = 1000\ P/\pi Dh$, where P = pressure on the ball in kg.; D = ball diameter in mm.; h = depth of hole made in mm. Tables and graphs are given for determining the relationships between H and the other physical and mechanical properties.

4905. Sekhar, A. C., and Bhatia, D. N. **Note on the evaluation of splitting coefficients of timber.** *Indian For. Bull. (n.s.)* No. 222, 1959. pp. 7. 3 refs. Price *Rs.* 1.37 (2*s.*).

Coefficients for splitting characteristics were determined and tabulated for 76 Indian species. The character used to evaluate resistance to splitting was tension across the grain.

4906. Mack, J. J. **Sub-Project T.M. 3–5. Progress Report No. 12. Some investigations on test procedure in nail withdrawal tests.** Division of Forest Products, Commonwealth Scientific and Industrial Research Organization, Melbourne. 1958. pp. 7. 11 refs. Limited distribution. P.R.

[Cf. *F.A.* 20 No. 1057.] Tests showed that the method of driving, whether mechanical or by hand, had a negligible effect on the static withdrawal resistance (s.w.r.) of nails, and that withdrawal rates of 0·065–0·52 in./min. had very little effect. The s.w.r. of nails did not noticeably change for the species tested, viz. *Pinus radiata*, *Eucalyptus diversicolor* and *E. regnans*, within 72 hours after driving.

812.8. Workability. Working Properties

See also No. 4858.

4907. Davis, E. M. **Machining properties of Red Alder and Bigleaf Maple.** *Wood-Worker, Indianap.* 78 (11), 1960 (10 . . . 25). P.R.

Gives brief results of recent U.S. planing, shaping, turning, boring and mortising tests with *Alnus rubra* and *Acer macrophyllum*.

813. Wood Chemistry

See also section 86 and No. 4874.

4908. Savard, J., Nicolle, J., and André, A. M. Analyse chimique des bois tropicaux. Tome II. **[Chemical analysis of tropical woods. Vol. II.]** *Publ. Centre Tech. For. Trop.* No. 16, 1959 (1960). pp. 250 + 11 dgms., 29 gphs. 111 refs. [F.]

Presents a detailed account of further studies: the application of paper chromatography to the analysis of wood and pulp; corrected cellulose by the Kürschner and Hoffer and the Seifert methods (the latter proving more economical and rapid); determination of uronic acids; decarboxylation with 19% HCl; influence of xylans on decarboxylation; determination of functions of acids in bleached pulp; determination of holocellulose (concluding that, in general, this has no interest from the point of view of analysis) and of lignin. The following tabulated data are given: (1) results of analyses of $\geqslant$ 10 specimens from different individuals of varied provenance of each of 7 species (*Triplochiton scleroxylon*, *Lophira procera*, *Mansonia altissima*, *Khaya senegalensis*, *Pycnanthus angolensis*, *Terminalia superba*, *Tectona grandis*) and 5 genera (*Brachystegia*, *Dacryodes*, *Daniella*, *Eucalyptus*, and *Piptadenia*); (2) SiO_2 content of 130 species (175 analyses); (3) methoxyl and acetyl indices for 75 species (169 analyses); (4) mannans and galactans for 59 species (87 analyses); (5) lignin and reducing agents for 45 species (59 analyses); (6) results of some 272 partial analyses of 234 species. Woods are indexed (i) alphabetically, (ii) systematically under families, and (iii) geographically (with native names).

4909. KRATZL, K., and PUSCHMANN, G. Präparative Trennungen mit Hilfe der Dünnschichtchromatographie. **[Preparative separation with the aid of thin-layer chromatography.]** *Holzforschung, Berlin* 14 (1), 1960 (1–4). 6 refs. [G.g.e.] P.R.

[Cf. *F.A.* 20 No. 3708.]. The advantages of thin-layer chromatography, using silica-gel/gypsum mixtures for preparative separation, isolation and purification of organic substances, are discussed in relation to other methods (e.g. paper chromatography), especially for work with radio-actively labelled compounds. It was possible to separate the products of oxidative degradation and of ethanolysis of softwood and hardwood lignin. By introducing coniferin into 2-year-old branches of Beech ca. 40 years old, it was found that after ethanolysis, not only vanilloylacetyl but also syringoylacetyl was radio-active. The plant was therefore able to methoxylate while retaining the ethanolysability of the lignin thus formed. *From authors' summary.*

813.1. Chief Organic Constituents. Constituents of the Cell Wall

See also Nos. 4891, 4924, 4931–2, 4933, 4944.

4910. **P6m-59. Tentative Standard: Determination of acid insoluble lignin in wood and pulp. P9m-59. Tentative Standard: [Determination of] Cross & Bevan cellulose in wood.** *APPITA, Melbourne* 13 (5), 1960 (174–5, 176–7). 2 refs.

4911. SMITH, D. M., and MIXER, R. Y. **The effect of lignin on the degradation of wood by gamma irradiation.** *Radiation Research, New York* 11 (6), 1959 (776–80). 12 refs. L.S.

There was negligible weight change in the wood or the holocellulose after irradiation and after conditioning in the hygrostat at 50% r.h. for 3 weeks. Gamma-radiation from Co^{60} does not affect the gross analytical composition of Redwood, and the naturally occurring aromatic compounds in Redwood (lignin and other extractives) reduce the number of scissions of cellulose chains caused by this same radiation. Full details are tabulated.

4912. BUCHER, H. **The decomposition of wood to cellulose as a topochemical reaction.** [A review.] *Chimia, Zürich* 13, 1959 (397–412). 42 refs. [G.] From *abstr.* in *Chem. Abstr.* 54 (9), 1960 (9284). P.R.

4913. SIMIONESCU, C. **Considerations on some results obtained in the study of vegetable cancer.** *Buletinul Institutului Politehnic din Iasi* (*n.s.*) 4 (3/4), 1958 (204–16 + 26 photos). 13 refs. [E.russ.rum.] E.M.B.

The author summarizes work already published on chemical changes in the wood of cankers occurring on Pine and Beech [cf. *F.A.* 18 No. 4569], and presents and discusses data from a similar study of an Elm tumour and a Poplar (*Populus nigra*). The results confirm previous findings that in cankered wood there is an increase in lignin and a corresponding decrease in cellulose, the sum of lignin + cellulose remaining constant at 70·51–74·83%.

4914. DURIE, R. A., LYNCH, B. M., and STERNHELL, S. **Comparative studies of brown coal and lignin. I. Infra-red spectra.** *Aust. J. Chem.* 13 (1), 1960 (156–68). 31 refs. O.R.S.

Spectra of brown coal, lignin preparations from Douglas Fir and Pacific Maple, and their derivatives, were compared. That of lignin treated with hydriodic acid was very similar to that of brown coal. Spectra are also given for Douglas Fir, (*a*) the complete wood, (*b*) wood with cellulose partly removed, (*c*) a hydrochloric-acid lignin, and (*d*) cellulose.

4915. CHOCHIEVA (ČOČIEVA], M. M., and NIKITIN, N. I. **Preliminary treatment of wood in relation to quality and yield of dioxan-lignin.** *Ž. prikl. Him.* 32, 1959 (613–6). [Russ.] From *abstr.* in *J. appl. Chem.* 10 (4), 1960 (408). O.R.S.

Treatment of wood (principally Oak) with 4% aqueous alkali or with the fungus *Polyporus sulphureus* effected ca. 95% removal of hemicellulose. Lignin extracted by dioxan + 0·1% HCl from wood given this preliminary treatment, was almost pure. Increased yields, however, were not obtained. When HCl is not used in the dioxan extraction, the method of preparation of the wood greatly affects the yield, which can be almost doubled by use of very fine sawdust or Oak wood powder.

4916. NAKANO, J., and SCHUERCH, C. **The reaction of Spruce lignin with t-butyl hypochlorite; a study of the accessibility of lignin in wood.** *J. Amer. Chem. Soc.* 82 (7), 1960 (1677–82). 9 refs. O.R.S.

4917. MOSHEIKO [MOŽEJKO], L. N., and SSERGEJEWA, W. N. [SERGEEVA, V. N.]. **[The nature of extracts from young shoots of fast-growing Poplars.]** *Latvijas PSR Zinātņu Akadēmijas Vēstis, Riga* 1958 (7), (51–6). [Russ.?] From *abstr.* in *Holzforschung, Berlin* 14 (1), 1960 (26). [G.] P.R.

[Cf. *F.A.* 21 No. 3701.] The investigations were concerned with the content of aromatic substances similar to lignin. In extracts (alcohol/benzene) kept for ca. two years, a precipitate was formed which, with $C_6H_5NO_2$ in an alkaline medium, gave aromatic aldehydes. Extracts from wood grown under short-day conditions, had a higher content of substances similar to lignin than wood grown under normal conditions.

4918. SCHÖNBACH, H. Ergebnisse weiterer Untersuchungen über Cellulosegehalt und Rohwichte Graupaer Pappelklone. **[Results of additional investigations on cellulose content and density of**

Poplar clones at Graupa.] *Wiss. Abh. Dtsch. Akad. LandwWiss., Berl.* No. 44 (*Beitr. Pappelforsch.* No. 4), 1960 (81–98). 9 refs. [G.g.russ.e.]

Despite large fluctuations of values, analyses of wood from 6- and 7-year-old stems largely confirmed the findings made on the same clonal material at ages 1–4 [cf. *F.A.* 18 No. 3724]. Cellulose content continued to increase with age, reaching 48·27% in *Populus* × *berolinensis* (*a*) at 7 years. It was lowest at 7 years in clones of the *P.* × *robusta* group (*b*) (46·42%) which, however, because of highest oven-dry density—0·472 vs. 0·415 in (*a*)—yielded most cellulose in kg./cu. m. Surprisingly [cf. *F.A.* 19 No. 4967] (*a*) had a tension-wood % of 9·3 compared with > 15 in (*b*) and the other groups examined.

4919. DUTTON, G. G. S., and HUNT, K. **The constitution of the hemicelluloses of Sitka Spruce (*Picea sitchensis*). III. Structure of an arabomethoxyglucuronoxylan.** *J. Amer. Chem. Soc.* 82 (7), 1960 (1682–4). 15 refs. O.R.S. [Cf. *F.A.* 20 Nos. 3718–9.]

4920. BISHOP, C. T., and COOPER, F. P. **Constitution of a glucomannan from Jack Pine (*Pinus banksiana*, Lamb).** *Canad. J. Chem.* 38 (6), 1960 (793–804). 40 refs. O.R.S.

Its structure was determined and compared with those of glucomannans found in other softwoods.

4921. TIMELL, T. E. **Isolation of a glucomannan from the wood of White Birch (*Betula papyrifera*).** *Chem. & Ind.* 1959 (28), (905–6). 7 refs. O.R.S.

Probably the first isolation of a reasonably representative hardwood glucomannan. It contains a higher proportion of anhydroglucose units than the glucomannans hitherto known.

4922. TIMELL, T. E. **Enzymatic hydrolysis of a 4-O-methyl-glucuronoxylan from White Birch (*Betula papyrifera*).** *Chem. & Ind.* 1959 (31), (999–1000). 3 refs. O.R.S.

4923. JAYME, G., and HAHN, G. Über den Polyuronid-Gehalt einiger deutscher Hölzer und daraus hergestellter Holo- und Hemi-Cellulosen. **[The polyuronide content of some German woods, and holo- and hemi-celluloses made from them.]** *Holzforschung, Berlin* 14 (2), 1960 (52–6). 52 refs. [G.g.e.] P.R.

Qualitative paper chromatography showed that glucuronic acid (*A*) and *O*-methyl-glucuronic acid (*B*) were present in wood of Beech, Poplar (*Populus* × *robusta*), Norway Spruce, Scots Pine and Robinia. Galacturonic acid (*C*) was present in all the woods except Pine. The total content of uronides was 4·8% in Beech (*A* 1·5; *B* 2·3; *C* 1); 4·6% in Poplar (1·5; 2·1; 1·0); 3·8% in Spruce (1·7; 1·6; 0·5); 3·3% in Pine (1·3; 2·0; 0); and 4·8% in Robinia. The results were in good agreement with those found by decarboxylation. Therefore, contrary to the opinion of other authors, pectic (polygalacturonic) acid did not contribute much to the total uronide content of these woods. During the preparation of holocellulose (by the Jayme-Wise method) the total *C* present is dissolved. It is concluded that the pectic acid is associated with the lignin of the middle lamella and appears to be relatively easily soluble, whereas the *A* and *B* are bound to the hemicelluloses. *From authors' summary.*

813.2. Minor Organic Constituents. Extractives

See also Nos. 4029, 4975, 4978, 5098.

4924. TSVETAEVA [CVETAEVA], I. P., and MERKUR′EVA, A. V. **Arabogalactan and other water-extractive substances of Siberian Larch.** *Ž. prikl. Him.* 32, 1959 (2707–11). [Russ.] From *abstr.* in *Chem. Abstr.* 54 (10), 1960 (10317). P.R.

The relative composition of the substances from the heart- and sapwood (h.w. and s.w.) was similar for *Larix sibirica* and *L. dahurica*. The water-extractive substance from the h.w. consists of 78·3–84% galactose, and 16·0–21·7% arabinose. Hydrolysis of the water extractive from the s.w. gave galactose, mannose, arabinose, xylose, and glucose.

4925. SMITH, L. V., and ZAVARIN, E. **Free mono- and oligosaccharides of some California conifers.** *Tappi* 43 (3), 1960 (218–21). 17 refs. P.R.

A survey based on the literature was made of the free sugars and lower oligosaccharides in the heartwood (h.w.), sapwood (s.w.), and inner and outer bark tissues (i.b. and o.b.) of several conifers, including *Libocedrus decurrens*, *Sequoia sempervirens*, *Pinus ponderosa*, *P. lambertiana*, *Pseudotsuga taxifolia*, *Abies magnifica*, *A. grandis*, *A. concolor* and *Taxus brevifolia*. Definite patterns characteristic for these tissues seem to be present, arabinose, glucose, galactose, xylose and certain methylpentoses being peculiar to the h.w. and o.b., and glucose, fructose, sucrose, raffinose and stachyose, to the s.w. and i.b.

4926. GARDNER, J. A. F., and BARTON, G. M. **The distribution of dihydroquercetin in Douglas-Fir and Western Larch.** *For. Prod. J.* 10 (3), 1960 (171–3). 17 refs.

Analysis of samples from (*a*) 6 Douglas and (*b*) 3 Larch trees by a colorimetric method [see *F.A.* 20 No. 1015] indicated that, in the heartwood, concentration increased with distance from pith. Variation within and between trees was considerable (0–1·5% in the heartwood of (*a*), 0–1·8% in that of (*b*) and 0–0·56% in sapwood). Resinous wood contained less than adjacent non-resinous wood. [Cf. *F.A.* 18 No. 932; 19 No. 2319.]

4927. ENZELL, C. **The chemistry of the natural order Cupressales. XXIV. Heartwood constituents of *Chamaecyparis thyoides* (L.) Britt.** *Acta chem. scand.* 14 (1), 1960 (81–5). 19 refs. [E.e.] O.R.S. [Cf. *F.A.* 21 Nos. 2353–4.]

4928. PILO, C., and RUNEBERG, J. **The chemistry of the natural order Cupressales. XXV. Heartwood constituents of *Juniperus chinensis* L.** *Acta chem. scand.* 14 (2), 1960 (353–8). 18 refs. [E.e.] O.R.S.

4929. LAIDLAW, R. A., and SMITH, G. A. **Heartwood extractives of some timbers of the family**

Moraceae. *Repr.* from *Chem. & Ind.* 1959 (1604–5). 13 refs. P.R.

The species examined were *Chlorophora tinctoria*, *Morus alba* and *Maclura pomifera*.

4930. ASENJO, C. F., *et al.* **Termite-repellent activity and chemical composition of West Indian Mahogany wood (*Swietenia mahagoni* Jacq.) with special reference to the P_2 fraction.** *Journal of Agriculture of the University of Puerto Rico, Río Piedras* 42 (3), 1958 (185–95). 7 refs. [E.e.span.] I.M.I.

[Cf. *F.A.* 21 No. 1006.] The termite-repellent activity of Mahogany seems to be due to a compound that is either extracted by petroleum ether, or inactivated *in situ* by this solvent. A solid waxy substance (P_2 fraction) isolated from the petroleum-ether extractive exhibited at times high repellent activity, but this varied from batch to batch. The P_2 fraction is a mixture of two major components and at least one minor one.

813.4. Chemical Effects of Heat. Chemistry of Thermal Decomposition

4931. SERGEEVA, V. N., KALNIŅŠ, A., and BISENIECE, S. **The decomposition of cellulose in wood lignocelluloses and cotton seed hulls during thermolysis.** *Trud. Inst. Lesohoz. Probl., Riga* No. 17, 1959 (77–82). [Russ.?] From *abstr.* in *Chem. Abstr.* 54 (10), 1960 (10311). P.R.

Discusses the possibility of directed thermal decomposition of cellulose in the lignocelluloses from Birch and Spruce with a view to increasing the yield of β-laevoglucosan. Extensive disintegration of wood lignocellulose in a vibrating mill destroys the structure of cellulose and decreases laevoglucosan yield, and the method described (involving thermolysis of the cellulose) is recommended for commercial use.

4932. SERGEEVA, V. N., and DOMBURGS, G. **A thermographic investigation of the thermal decomposition of lignocellulose.** *Trud. Inst. Lesohoz. Probl., Riga* No. 17, 1959 (83–92). [Russ.?] From *abstr.* in *Chem. Abstr.* 54 (10), 1960 (10314–5). P.R.

Gives results of investigations made to ascertain the course of decomposition of cellulose from Aspen lignocellulose as a function of various factors, viz. type of thermal treatment, state of starting material (e.g. particle size), and the content of pentosans or other easily hydrolysable carbohydrates, under conditions ensuring maximum glucosan yield.

813.5. Reaction with Metals

4933. MARIAN, J. E., and WISSING, A. **The chemical and mechanical deterioration of wood in contact with iron. Part 1. Mechanical deterioration. Part 2. Chemical decomposition. Part 3. Effect of some wood preservatives. Part 4. Prevention of deterioration.** *Svensk PappTidn.* 63 (3–6), 1960 (47–57; 98–106; 130–2; 174–83). 53 refs. [E.e.sw.g.] P.R.

(1) Laboratory tests on veneers (tensile tests) and 15-mm. cubes (compression tests) of *Pinus sylvestris* exposed to contact with rusting iron for periods of up to 9 months showed that: (*a*) tensile strength decreased significantly, the decrease being more rapid in sapwood than in heartwood, whereas compression strength was not affected; (*b*) delignification of samples after exposure to contact with iron, leaving holocellulose with only small amounts of lignin present, reduced the compression strength without affecting the tensile strength. It is concluded that contact with rusting iron affects mainly the holocellulose fraction of the wood, and only slightly, if at all, the lignin. (2) Samples were taken partly from the material used in (1) that had been exposed to rusting iron for 9 months, and partly from untreated railway sleepers after 10 years' service. Results of chemical examination confirmed that the changes induced by contact with rusting iron consist, at least in the early stages, in decomposition of hemicellulose into NaOH-soluble fission products. A theory is presented that this decomposition of polysaccharides in wood is caused by autoxidative chain reactions influenced by the presence of metal ions. (3) Samples of veneers similar to those used in (1) were impregnated with (*c*) creosote or (*d*) a Zn-Cr arsenate preservative (Boliden Salt K33). (*c*) Tensile strength figures were generally significantly lower in rusted samples than in non-rusted controls, but the decrease in strength was less than in untreated samples. (*d*) Loss of tensile strength was higher in treated than in untreated samples, sapwood being more affected than heartwood. Preservative retention was, however, unusually high, and the controls were not identical with the material used for preservative treatment. (4) In laboratory tests with material and conditions similar to those in (1), deterioration was prevented by galvanizing the iron or by applying a water-resistant synthetic resin to it. Further work is needed to establish the durability of the coating in service. Results of impregnating the sapwood with antioxidants and of using a generated (imposed) electric current to give protection were less consistent and further research is needed.

4934. GRAY, V. R., and WHEELER, M. E. **Acidity and corrosive effects of Redwood and Whitewood.** *Res. Rep. Timb. Developm. Ass., Lond.* No. *C/RR/*7, 1959. pp. 7. 7 refs. Price 3*s.* 6*d.*

Measurements of pH on 35 samples of *Pinus sylvestris* and 37 of *Picea abies* and *Abies alba* showed mean values of 4·64 and 4·69 respectively. Although a proportion of samples of each timber is capable of accelerating the corrosion of iron under damp conditions, the pH of samples of low and high acidity reaches a value unlikely to enhance corrosion after a short time (e.g. 4 months in an enclosed bottle at 25° or 40° C. and 80% r.h.).

813.6. Effect of Chemicals on Wood. Resistance to Chemical Attack

See No. 5015.

813.8. Poisonous and Irritant Properties

4935. BELLWINKLE. **Toxic woods.** *FDC Newsletter, London* No. 20, 1960 (2). P.R.

Summarizes the main points of a recent German article [not cited], covering briefly the nature of skin injuries arising from increased contact with various exotic species, handling precautions, and procedure in cases of injury.

4936. **Dangerous woods.** *FDC Newsletter, London* No. 22, 1960 (3). P.R.

Briefly presents the general conclusions of a survey on the possible harmful effects of working Mansonia and Makore, with suggested precautions.

814. Natural Durability. Old Wood. Fossilized Wood

See also Nos. 4080, 4930, 5056–7, 5076–7.

4937. RICHARDSON, F. **A method of reviving sections of compressed wood from archaeological sites and peat-bogs.** *Kew Bull.* 14 (1), 1960 (85–6 + 1 plate).

Describes in detail a method consisting essentially in immersing ½-in. cubes of material in 95% alcohol for 24 hr., cutting sections (without embedding) $\nless 30\mu$ thick, passing these successively through 50% alcohol, water, and Na hypochlorite, when, after washing, a section is transferred to a slide and treated with a solution of $ZnCl_2$, chlor-zinc-iodine, or HCl, warming cautiously, and irrigating with water to remove the reagent when the section is fully expanded. The method is unsuitable for calcified or silicified woods.

4938. NARAYANAMURTI, D., *et al.* Untersuchungen an altem Holz aus dem Flussbett des Ganga bei Mokameh, Bihar. **[Investigations on ancient wood from the bed of the Ganges River, near Mokameh, Bihar.]** *Holz Roh- u. Werkstoff* 18 (2), 1960 (55–8). 11 refs. [G.g.e.] P.R.

The wood, ca. 30,000 years old, was identified as *Acacia* sp. Data are given on its anatomical characteristics, fine structure, physical properties, and chemical composition. Strength properties were affected by the considerable loss of cellulose, due to anaerobic decomposition.

815. Effect of Growth Factors on Structure and Properties

See also Nos. 4860–2, 4864, 4868–9, 4880, 4895–7, 4917, 4926, 4998–9.

4939. ZIEGER, E. Über die Abhängigkeit der Rohholzqualität vom Standort. **[The relations of wood quality and site.]** *Repr.* from *Wissenschaftliche Zeitschrift der Technischen Hochschule Dresden* 8 (3), 1959 (573–8). 13 refs. [G.g.]

Discusses the frequently conflicting views in the literature (particularly German research on conifers) and methods of research suitable for various aspects (commercial, technological, etc.) of the problem. An [unpublished?] study by *Leidereiter* is cited, showing differences in ring width, density, and compression strength between pulpwood from two sites near Freiberg, Saxony; the wood from the poorer, smoke-affected sites required considerably more energy for grinding.

4940. PAUL, B. H. **The effect of environmental factors on wood quality.** *Rep. U.S. For. Prod. Lab., Madison* No. 2170, 1959. pp. 48 + 1 tbl. 57 refs.

A review, based on many specific studies, of the various environmental factors influencing the growth of conifers and hardwoods in the U.S.A., and of the structural characteristics of wood that affect its quality.

4941. CHIDESTER, G. H., BRAY, M. W., and CURRAN, C. E. **Growth factors influencing the value of Jack Pine for kraft and sulfite pulps.** *Rep. U.S. For. Prod. Lab., Madison* No. 1286 (rev.) 1959. pp. 7 + 3 gphs., 10 tbls. P.R.

Revision of a paper presented in the T.A.P.P.I. meeting held in September 1939 at Syracuse, N.Y. [see *F.A.* 1 p. 285 *G. H. Chidester et al.*].

4942. PECHMANN, H. VON, and WUTZ, A. Haben Mineraldüngung und Lupinenanbau einen Einfluss auf die Eigenschaften von Fichten- und Kiefernholz? **[Do mineral fertilizers and lupins influence the properties of Norway Spruce and Scots Pine wood?]** *Forstwiss. Cbl.* 79 (3/4), 1960 (91–105). 16 refs. [G.g.]

Various fertilizers were applied, or lupins sown, in slow-growing Spruce and Pine stands of various ages and on various sites in Germany, and the wood laid down after this treatment was examined. This showed that, in Spruce, repeated applications of N (after doses of lime and P) appeared to increase the early-wood %, while scarcely altering the cell-wall thickness; density was reduced, at least temporarily, but wood structure and density were similar to those of faster-grown Spruce on good sites. In Pine, the densest wood usually occurred in rings 1–1·5 mm. wide, and, as long as fertilizing did not increase ring width greatly above this, no reduction in wood density should be feared. In Pine > 200 years old, fertilizing increased the formation of early wood. It is thought that, though fertilizing is a suitable measure in older, slow-growing stands of both species, it may have an unfavourable influence on young Pine on good sites where veneer wood is produced.

4943. CASTIGLIONI, J. A. Método para determinar el nivel radial de extracción de muestras de madera. **[Method for determining the position, along a radius of the cross-section, from which a wood specimen has been taken.]** *Notas tecnol. for. Adm. Nac. Bosques, B. Aires* No. 1, 1959. pp. 8. 5 refs. [Span.]

Formulae are presented, with tables for determining the radius corresponding to an arc drawn along a growth ring or some other concentric character in the specimen.

4944. ZOBEL, B., HENSON, F., and WEBB, C. **Estimation of certain wood properties of Loblolly and Slash Pine trees from breast height sampling.** *For. Sci.* 6 (2), 1960 (155–62). 13 refs.

Presents results of investigations on sp.gr. and cellulose yields of *Pinus taeda* and *P. elliottii* var. *elliottii*, confirming earlier information on the relationships of the cellulose yields of b.h. samples to those of the total bole [cf. *F.A.* 21 No. 2372].

The closest relationships are obtained by comparing total b.h. values (i.e. values for outer plus core wood) with those of the total bole; but, though this procedure is highly satisfactory for young stands, the most practical relationship for older trees containing heartwood or resin, or for trees having defects or compression wood at the heart, is that of outer wood (o.w.) at b.h. to total o.w. in the bole. The possibility of using a core-wood sample from a young tree in predicting wood properties of the total tree values at maturity would obviously shorten the time necessary for progeny tests of wood characteristics in selected genetic material. However, there is not yet sufficient information to publish generalized regression equations for either sp.gr. or cellulose yields, and it is still necessary to sample enough trees in a given area for an equation applicable to that area to be determined. The most encouraging point arising from the data so far collected is that a sample at b.h. can be used as a satisfactory indicator of sp.gr. and certain cellulose yields for the whole tree. Fibre length also appears to follow the same pattern, although as yet insufficient data are available to determine any statistical significance. [Cf. *F.A.* 20 No. 5305; 21 No. 960.]

4945. WELLWOOD, R. W. **Specific gravity and tracheid length variations in second-growth Western Hemlock**. *J. For.* 58 (5), 1960 (361–8). 25 refs.

Cross-section disks at 3 levels in the stem were examined from 39 *Tsuga heterophylla* representative of 60-year stands covering 3 crown classes and 5 site indexes. Sp.gr. determinations showed maximum values at the base of the stem and minimum values at the top section. Late-wood % in the growth ring, determined macroscopically, had no significant effect on sp.gr., but rate of growth had a highly significant effect. Tracheid length was measured in 18 trees, at every 5th, 10th, 15th and 20th ring from the pith and every 10th ring thereafter, at 3 heights in the stem. Site had no effect, whereas crown class had, tracheid length being maximum in co-dominant trees. There is an apparent genetic effect whereby trees having tracheids initially either shorter or longer than the mean will retain that feature as they continue to grow. *From author's summary.*

4946. STEVENS, W. C., and JOHNSTON, D. D. **Distortion caused by spiralled grain**. *Timb. Technol.* 68 (2252), 1960 (217–8).

Endeavours to find a relationship between the angle of spirality and the angle of twist induced by dimensional changes resulting from moisture changes. The degree of twisting of a hollow cylinder composed of a very narrow annual ring from a log containing spiral grain was calculated geometrically, and this result was compared with actual measurements on a wooden tube. It appeared that an increase in radius, unless offset by an increase in the spirality angle, led—other things being equal—to a decrease in the angle of twist. The pattern of spirality within an tree appears to be so complex, and the formation of internal stresses and "sets" so involved, that it is virtually impossible to estimate from spirality angle measurements the actual extent of the twist that will occur in a log, board or plank gaining or losing moisture over a given range of m.c.

82. Conversion, Shaping, Assembly and Finishing of Wood: General

4947. THUNELL, B. **Determination of cutting forces in woodworking**. *Transl. Commonw. Sci. Industr. Res. Organ. Aust.* No. 4024, 1958. pp. 16 + 4 photos., 10 dgms., 8 gphs. 57 refs. Transl. by W. McKenzie from *Holz Roh- u. Werkstoff* 16 (4), 1958 (138–45). [See *F.A.* 20 No. 2360.] Limited distribution.

4948. SERRY, V. **What causes cutter wear on woodworking machinery?** *Timb. Technol.* 68 (2250), 1960 (136–7). 3 refs.

An exposé of Kivimaa's work [see *F.A.* 14 No. 3774].

4949. REINEKE, L. H. **What are the relationships of feed speeds for cutting tools?** *Wood Wkg. Dig.* March, 1960 (83–5). P.R.

Presents, and explains the uses of, a graduated chart designed to simplify straightforward single computations and to facilitate investigation of the effect of changing the speed, feed to, or numbers of, cutting edges, and analysis of their interrelationships. The chart is applicable to rotary cutters such as shapers, planers, cylinder or disk chippers, and circular saws. The wide range of values provided by the scales for the interrelated factors can be extended by multiplying or dividing the scale values by 10 to accommodate the high rotational speeds of air-driven routers or the very slow feed rates of drills and augers.

4950. Tekniska meddelanden från leverantörer till sågverk, cellulosafabriker och pappersbruk. **[Technical information from suppliers to sawmills, and pulp and paper mills.]** *Svensk Trävarutidn.* Annual issue, 1958 (1959), (113 . . . 127). [Sw.]

Descriptions and specifications include saws and planers (Jonsereds Fabriker AB), equipment for sorting at the floating depot (Tornborg and Lundberg AB), and new friction barking equipment for bundled wood (Waplans Mekaniska Verkstad AB).

4951. Messeheft 1960. **[Fair number 1960.]** *Holz-Zbl.* 86 (45/46), 1960. pp. 216. [G.]

Describes exhibits, mostly woodworking machinery, at the German Industries Fair, including the Dolmar automatic pivoting chain-saw, a large stationary one-man cross-cutting saw for landings or timber yards, in which one end of the exchangeable sawing unit (guide plate and chain) is so joined to the motor part that it can be raised and lowered hydraulically, the feed pressure in cutting also being hydraulic. Special articles include: Measuring the noise from a circular saw (*C. Pahlitsch* and *W. Meins*) [indicating that noise increased with blade thickness and number of teeth; supporting collars with a diameter of ca. two-thirds that of the blade reduced the noise].

4952. Deutsche Industrie-Messe Hannover 1960. **[German Industries Fair, Hannover 1960.]** *Int. Holzmarkt* 51 (8), 1960 (9 . . . 52). [G.]

The greater part of the issue is devoted to brief illustrated descriptions of woodworking machinery, kilns, etc. exhibited.

821. Barking

4953. Liiri, O. Kuoren poistaminen koivuhakkeesta. **[Barking Birch chips.]** *Pap. ja Puu* 42 (4), 1960 (293–8). [Fi.e.*e.*] P.R.

Results of tests at the Wood Technical Laboratory of the State Institute for Technical Research, Helsinki, on removing the bark from chips in a hammer mill [illustrated] were not entirely satisfactory; the outer bark could be loosened in certain conditions, but the mill tended to crush the chips, and bark and chips had still to be separated. In another method, chips were simply soaked in water, the bark-free chips sinking. Ca. 90–95% of the bark was removed in this way, and only 1–3% of the wood retained bark. Results are tabulated and illustrated by photographs. Tests are preliminary and further research is needed. *From author's summary.*

822. Saws and Sawing

See also Nos. 4432–4, 4451, 4991.

4954. **Woodworking saws for hand use. Part I. Hand saws.** *Brit. Stand.* No. 3159: Part I, 1959. pp. 18. Price 5*s.* P.R.

Covers nomenclature, material, hardness, teeth, proportions and finish, marking, and testing (bending, setting, straightness, performance).

4955. Kamaljutdinova, M. H. O čistote poverhnosti pilomaterialov ramnoj raspilovki. **[Surface cleanness in frame-sawing.]** *Derev. Prom.* 8 (11), 1959 (14–7). [Russ.russ.] P.R.

Pine and Spruce were frame-sawn with swaged saws 1·8, 2, and 2·2 mm. thick, having tooth pitches of 22 and 26 mm., sharpness angle 45°, hook 15°, and clearance angle 30°. The most frequent type of surface defect was small tears. There was virtually no difference in surface cleanness between the species, nor as a result of variations in wood moisture, in the range normally encountered in frame-sawing. With other factors constant, increasing the depth of cut tended to improve, and increasing the thickness of the boards cut to impair, the surface cleanness. Surface cleanness of boards sawn from the centre of the log (or squared piece of timber) was inferior to that of boards from the outer parts. Kiln-drying the boards after sawing had no influence on cleanness.

4956. Fukui, H. **[Surface roughness of wood in cutting by woodworking circular saw blade. II. Influence of feed rate of timber (discussion on structure of sawed surface).]** *J. Jap. Wood Res. Soc.* 6 (2), 1960 (79–84). 13 refs. [Jap.jap.e.*e.*] P.R.

Presents tabulated and graphical data [in English] on the relationship between the feed rate and roughness of the sawn surface in *Cercidiphyllum japonicum*, and discusses various features of the surfaces obtained with different types and makes of blade.

4957. Gurkin, G. S. Poterja ustojčivosti ploskoj formy ravnovesija pil'nogo diska pri dejstvii temperaturnyh naprjaženij. **[Losses of stability in the plane form of equilibrium of a circular saw blade due to heat stresses.]** *Lesn. Ž., Arhangel'sk* 2 (1), 1959 (112–25). [Russ.]

A detailed mathematical study.

4958. Hyler, J. **Are you using circular saw blades to the best possible advantage?** *Wood Wkg. Dig.* May, 1960 (79–83). P.R.

Describes various circular-saw applications on machines (especially on moulders and shapers) not originally designed as sawing units, but provided with attachments of different types to accommodate circular saws.

4959. Kovalenko, A. A. O stojkosti kruglyh pil pri raskroe drevesno-stružečnyh plit. **[The wear resistance of circular saws in sawing chipboards.]** *Derev. Prom.* 9 (2), 1960 (17–8). 1 ref. [Russ.] P.R.

Tests were made on boards (1) of mean density 0·51 g./c.c., and 8% resin content, and (2) 0·74 g./c.c., 10% resin, with circular saws having teeth of various shapes, running at 3000 rev./min., with a saw speed of 55 m./sec. and a feed speed of 6–6·2 m./min. Tooth wear was measured after various spells of work, and the data are tabulated and graphed. It is concluded that tooth wear is significantly greater than in sawing ordinary wood, and the saw should not work for > 15–20 min. without resharpening. Saws used for cross-cutting wood, i.e. with a negative hook angle (−15°), and a sharpness angle of 50–60°, performed best.

4960. Simmonds, A. **What is a wide bandsaw?** *Woodwkg. Ind.* 17 (4), 1960 (189–90). P.R.

Briefly defines the term "wide bandsaw" as being a saw fulfilling one or more of the following requirements: (i) of $\nless 3$ in. width, this minimum figure referring to the width of the original bandsaw strip from which it is made; (ii) requiring tensioning; (iii) used for the conversion and re-sawing of timber. Gauge, or thickness, requirements are also explained, and advice on the storage of bandsaws and the treatment of new ones is given.

4961. Jones, D. S. **Indexing on automatic saw-grinding machines.** *For. Prod. Newslett. C.S.I.R.O. Aust.* No. 263, 1960 (3–4).

Describes and illustrates the correct way of setting an indexing pawl so as to bring the tooth pitches of both band and circular saws to a uniform dimension.

4962. Kivimaa, E. **A new method of swaging saw teeth.** *Timb. Tr. J.* 233 (4362), 1960 (89, 91–2).

Describes and illustrates the method, which involves equipping the swaging excentric die with fixed side-limit stops, so preventing undue spread of the tooth point and giving the prescribed shape and size to the cutting point of the tooth. The method has so far been used in Finland only on frame saws, but there seems to be no reason why it should not also be used on band and circular saw blades.

823. Planing. Cutting of Mouldings. Chiselling, Mortising and Tenoning. Boring. Turning

See also Nos. 4433, 4907.

4963. MORI, M., and HOSHI, T. **[Studies on surfacing of wood with planer. I. On cut-surface roughness of wood.]** *Bull. For. Exp. Sta., Meguro, Tokyo* No. 119, 1960 (79–93). 11 refs. [Jap.jap. *e.e.*]

Presents extensive tabulated and graphical data (in English) showing the effects of such factors as knife angle, feed rate, knife width and pitch, on the surface profile of planed timber. The following species were studied: *Cryptomeria japonica*, *Tilia japonica*, *Fraxinus mandshurica*, *Machilus thunbergii*, *Paulownia tomentosa*, *Picea jezoensis*, *Quercus mongolica*, *Q. myrsinaefolia*, *Abies firma*, *A. sachalinensis*, *Cinnamomum camphora*, *Fagus crenata*, *Betula maximowicziana*, *Tsuga sieboldii*, *Chamaecyparis obtusa*, *Magnolia obovata*, *Zelkova serrata*, and *Distylium racemosum*.

4964. PIŽURIN, A. Ėksperimental′naja gidroficirovannaja ustanovka dlja issledovanija processa točenija drevesiny. **[An experimental hydraulic rig for investigating the process of turning wood.]** *Lesn. Ž., Arhangel′sk* 2 (1), 1959 (132–43). [Russ.]

A detailed description of the rig. Results of its use are to be published later.

824. Forms of Joint. Jointing and Assembly

824.1. Nailed Joints

See Nos. 4906, 5010, 5016.

824.8. Glues and Gluing

See also Nos. 4832, 4838, 5001, 5003–6, 5010, 5019, 5123–4, 5173.

4965. PLOMLEY, K. F. **The effect of soluble salts on the gelation of tannin-formaldehyde.** *Repr.* from *Aust. J. appl. Sci.* 10 (4), 1959 (494–7). 2 refs.

Describes adhesion tests on Karri, Celtis and Hoop Pine plywood, using Wattle tannin-formaldehyde adhesives at pH 5, containing 0, 5, or 10% Mn acetate. Significant adhesion improvement was observed at 5%, but results at 10% were not much better than for controls. Tabulated data for the standard shear specimens used in accordance with *Aust. Stand.* No. *K*88, 1952 [see *F.A.* 15 No. 4142] are presented, showing the effects studied.

4966. DRIEHUYZEN, H. W., and WELLWOOD, R. W. **Effect of temperature and humidity of glue room on open assembly time.** *For. Prod. J.* 10 (5), 1960 (254–9). 15 refs.

Tests at 70 and 90° F. and 35 and 75% relative humidity indicated that lower temperatures and higher r.h. permitted substantially higher open assembly times in the gluing of Douglas Fir laminated structural members. For casein, which was more sensitive than resorcinol, the other adhesive tested, the time increased from 15 to 45 min. for a 900 lb./sq. in. shear-failure load.

4967. STERLIN, D. M. Primenenie vysokokipjaščih teplonositelej pri teplovoj obrabotke drevesiny. **[The use of heating agents with high boiling points in the heat treatment of wood.]** *Derev. Prom.* 8 (12), 1959 (5–7). [Russ.] P.R.

The suitability is examined of using (*a*) ditolylmethane, and (*b*) dicumylmethane as heating agents in conventional drying and hot-pressing operations, instead of water vapour, which, because of the high pressures involved, is not practicable at > 140–$160°$ C. Both (*a*) and (*b*) can be used in the liquid phase without modifications to existing heating equipment since there is no need for pressures > 1–$1{\cdot}5$ atm. to obtain 260–270°, while at the other extreme the agents solidify at $-30°$ to $-36°$ (*a*) and $-22°$ to $-24°$ (*b*). Calculations showed that the productivity of an (*a*)-heated roller-drier was 2·5 times as much as, and its fuel consumption per cu. m. of veneer dried 30% less than, those of conventionally heated driers. On this basis, it is estimated that it should be possible to reduce [Soviet] mass-production costs to $\frac{1}{8}$–$\frac{1}{10}$ of their present level, and to use (*a*) and (*b*) successfully for (i) high-temperature drying of wood with heaters of small surface-heating area; (ii) high-temperature drying of veneers; (iii) rapid drying in match manufacture; (iv) rapid gluing of plywood; (v) rapid (hot-) pressing of chipboard, etc.

4968. KOVAL′ČUK, L. M. Dolgovečnost′ soedinenij pri skleivanii s podogrevom TVČ. **[The durability of joints glued with R.F. heating.]** *Derev. Prom.* 9 (1), 1960 (10–2). [Russ.russ.] P.R.

[Cf. *F.A.* 20 No. 5197.] Several different Soviet resins were used to glue samples of Oak and Pine with R.F. heating. Some samples were exposed in the open for up to 18 months, and others given accelerated ageing treatments. Shear-strength tests were made at intervals, and the results graphed. It was determined which resins were suitable for use with R.F. heating with low- and high-density woods; more durable bonds were obtained with low-density woods, e.g. Pine and Spruce.

825. Cleaving. Adzing. Mechanica Comminution

See also Nos. 4432, 4481, 4953.

4969. JONAITIS, S. Medienos skėlimo eigos skaičiavimo metodas. **[Method of calculating the cleavage of wood.]** *Liet. Miškų Ūkio Moksl. Tyr. Inst. Darb.* No. 3, 1958 (249–57). 4 refs. [Lith. russ.]

Describes experiments on splitting Pine with wedges of various angles. From tests and calculations it is shown that for splitting a piece of wood right through in the tangential plane the following simplified formula, which eliminates the force applied to the wedge, is valid: $S = 0{\cdot}241\ l/\tan \delta_N$, where S is the depth the wedge has to be driven into the wood in order to split it; l is the length of the piece of wood; and δ_N is half the angle of the wedge blade. For splitting in the radial plane $S = 0{\cdot}274\ l/\tan \delta_N$.

826. Peeling. Slicing. Trimming, Edging etc. of Thin Sheets

See also No. 5000.

4970. HOADLEY, R. B. **A cutting device for laboratory-scale veneer studies**. *For. Prod. J.* 10 (5), 1960 (258–62). 6 refs.

Describes an apparatus, still in the development stage, in which a small wood block, attached to the pendulum of a modified Izod-Charpy impact testing machine, is intercepted by a rigidly mounted knife. Preliminary tests with specimens of Basswood and Sugar Maple, measuring the effect of nosebar pressure and knife angle on energy consumption, were promising.

4971. FEIHL, A. O. **Setting veneer lathes with aid of instruments**. *Tech. Note For. Br. Can.* No. 14, 1960. pp. 22 + 1 tbl.

Contains detailed information on the construction and use of suitable instruments (including descriptions of some developed at the Forest Products Laboratory, Ottawa) for setting veneer lathes, and shows recommended lathe settings for various species and thicknesses of veneer. A table showing optimum lathe settings and log temperatures for rotary veneer cutting is appended.

4972. LENEY, L. **A photographic study of veneer formation**. *For. Prod. J.* 10 (3), 1960 (133–9). 9 refs.

Presents a series of photomicrographs taken under experimental conditions on *Populus deltoides*, *Acer saccharinum* and *Pinus lambertiana*. Most lathe checks appeared to be tension failures, not necessarily perpendicular to the cutting plane, and stresses leading to checks were reduced by increasing the cutting angle. Microsharpening [cf. *F.A.* 20 No. 2392] effectively maintained a cutting edge when the cutting angle was increased.

4973. COLLINS, E. H. **Lathe check formation in Douglas Fir veneer**. *For. Prod. J.* 10 (3), 1960 (139–40). 2 refs.

An analysis of a high-speed film taken under near-production conditions on a roller-bar production lathe, to investigate the effects of nosebar pressure, cutting speed, etc. In the range of speeds investigated (250–600 ft./min.), increased speed gave improved smoothness. Higher nosebar pressures produced smoother veneer with shallower but more numerous lathe checks and permanent cell compression in the early wood.

4974. NAKAMURA, G., and SAITO, M. **[Studies on rotary lathe cutting. Report (III). Effect of cutting conditions on the quality of Basswood, Aspen and Tulip tree veneer.]** *Bull. For. Exp. Sta., Meguro, Tokyo* No. 119, 1960 (67–78). 10 refs. [Jap.jap. e.*e.*]

[Cf. *F.A.* 21 No. 2394.] Describes tests on *Tilia japonica*, *Populus maximowiczii*, and *Liriodendron tulipifera*.

827. Bending. Moulding (other than by Cutting)

See Nos. 4858, 5005.

829.1. Finishing

See also Nos. 5013, 5018.

4975. NORD, F. F. **Research Project, Index No. 5. 101049. Interim Report A, 1959. Redwood colour stabilization**. California Redwood Association, San Francisco. 1959. pp. 6. P.R.

To determine if the polyphenolic colouring matter in Redwood can be stabilized by coupling it with diazonium salts and other compounds, matched sets of panels were treated [treatments described in detail] some being subsequently exposed to natural conditions and others kept unexposed for control. After 31 weeks' exposure, the test panels had lost their "deposited" colour, and it was concluded that the salts, as applied to these natural weathering panels, could not stabilize the colour of Redwood.

4976. BYSTROV, G. P., ŽESTJANIKOV, V. M., and AL′FTAN, É. A. Vlijanie ul′trazvukovyh kolebanij na process krašenija drevesiny. **[The influence of ultrasonic oscillations on the process of dyeing wood.]** *Derev. Prom.* 9 (2), 1960 (15–6). [Russ.] P.R.

It was considered theoretically probable that the generation of ultrasonic oscillations in a liquid would increase the penetration of that liquid into wood immersed in it, because of (1) the cavitation effect; (2) elastic oscillations caused in the wood surface layers; and (3) the intensive mixing of the liquid. Accordingly, dyeing experiments were made on Beech and Pine to test the validity of the theory, using an oscillation frequency of 20 kilocycles/sec., and dye maintained at 60–70° C. Pine proved easier to dye than Beech; penetration depth after 30 min. immersion was 3–4 mm. in Pine and < 1·5 mm. in Beech given the ultrasonic treatment, vs. < 0·1 mm. for controls without ultrasonic treatment.

4977. SCHÜRER, H. Der Bau von Breitband-Kontaktschleifern und deren Einsatz in der Möbelindustrie. **[Construction of wide-belt contact sanders and their role in the furniture industry.]** *Holz Roh- u. Werkstoff* 18 (4), 1960 (140–1). [G.g.e.] P.R.

4978. SANDEMANN, W., DIETRICHS, H.-H., and PUTH, M. Über die Trocknungsinhibierung von Lackanstrichen auf Handelshölzern. **[Inhibition of the drying of coatings on commercial timbers.]** *Holz Roh- u. Werkstoff* 18 (2), 1960 (63–75). 29 refs. [G.g.e.] P.R.

Five finishes (Desmophen-Desmodur, a synthetic resin; urea-formaldehyde resin varnish; nitrocellulose lacquer; oil varnish; unsaturated polyester lacquer) were tested on wood specimens and extracts from 93 different species [the same as those mentioned in *F.A.* 21 No. 5077]. The compatibility of the woods and finishes was examined and the results tabulated, showing whether inhibition, discoloration, etc. occurred. Drying of the finishes was impaired on a number of species, depending on the content of inhibitory extractives, this in turn being influenced by the site and by the position of the specimen in the stem. Polyester finishes were inhibited mainly by extractives of a quinoid character and by oxystilbene, which can form quinonmethide.

Sealing with Desmophen-Desmodur, or using modified polyester finishes can prevent inhibitory effects with polyesters.

4979. ANSTRUTHER, A. M. **Specification and selection of silicone water repellents**. *Roy. Engrs'. J.* 73 (3), 1959 (303–6).

4980. GRAY, V. R., and WHEELER, M. E. **Waterproofing. Timber waterproofing agents**. *Res. Rep. Timb. Developm. Ass., Lond.* No. *C/RR*/6, 1959. pp. 10 + 8 photos. 9 refs. Price 3*s*. 6*d*.

The effectiveness of a number of water repellents for wood was assessed by measuring the wetting angle of water on *Thuja plicata* treated with the repellents before and after exposure to the weather for 1 year. It was found that waxes and wax solutions gave the most durable results and that "sealers", linseed oil and silicone resin lost their value within a year, though linseed oil was much improved when combined with a wax. Effective water repellency in timber was shown to be inevitably associated with attraction for atmospheric dirt.

83. Timber Manufacturing Industries and Products. Uses of Wood as Such

See also No. 4838.

831. Fuelwood and Various Types of Rough Timber

See also Nos. 5031, 5034–8, 5080, 5101.

4981. LÜNZMANN, K. Die Bedeutung des Holzes als Träger der Primärenergie. **[The importance of wood as a source of primary energy.]** *Forstarchiv* 31 (4), 1960 (25–7). 11 refs. [G.]

Discusses the role of wood as the demand for energy has grown over the last century. Total energy production in W. Germany in 1957 is analysed according to source (wood, gas, oil, coal, etc.) and compared with world figures. A table shows the price per million kcal. from each source for the Hamburg region. The kcal. yield of 17 types of timber is given by weight and volume, and the effect of varying moisture content shown.

4982. CARVALHO, J. DA SILVA. Algumas considerações sobre lenhas, seu valor combustível relativo, disponibilidade e distribuição. **[Notes on fuelwoods, their relative fuel value, availability and distribution.]** *Estud. Inform. Serv. Flor. Aqüic. Portugal* No. 116-*E*2, 1959. pp. 27. 7 refs. [Port.] Limited distribution.

Reviews the basic factors affecting the value of wood as fuel, discusses the dimensions and manufacture of fuelwood, and presents some data on the production and distribution of fuelwood in Portugal, with notes on some of the most suitable species.

4983. HUSAIN, T. **Fuelwood in Pakistan**. *For. occ. Pap., FAO* No. 7, 1959. pp. 32.

Covers demand and supply, fuelwood plantations (irrigated and non-irrigated) and calorific value of Pakistan fuel species.

4984. THEIN, U. **The fuelwood situation in Burma**. *For. occ. Pap., FAO* No. 6, 1959. pp. 116 + 4 maps, 6 photos, 4 dgms.

Following a description of the physical features, geology, and climate of Burma, the distribution, employment and forestry needs of its population, the main forest types, and the present position of forest reservation and management—areas tabulated, including areas of both territorial (administrative) and working (plan) circles—the whole fuel and charcoal economy of the country is reviewed and summarized in a table (p. 40) and supported by an analysis for each territorial circle and division. An account of the Dry Zone Afforestation schemes and of the situation in the areas not under forest administration, notably Kayah State and the Shan States, is also given. Recommendations include some for extending forest reservations for timber production and catchment protection as well as for fuel, and for extending village forests; also specific measures to control taungya, and information about the recent creation of new forest divisions.

4985. BRÆNDEGAARD, J. Anvendelse af brænde i en middelstor varmecentral. **[Use of fuelwood in a central heating plant of medium size.]** *Dansk Skovforen. Tidsskr.* 45 (2), 1960 (85–93). [Dan.]

Presents data for costs of heating a group of buildings from centrally-placed furnaces, one fired with oil and the other with fuelwood, in 1956–59. Heating with fuelwood proved more economical and a third furnace, installed in 1958, is for fuelwood.

4986. MCGOWAN, W. M. **The strength of Douglas Fir telephone poles**. *F.P.L. tech. Note For. Prod. Lab. Can.* No. 15, 1960. pp. 22 + 2 tbls. 12 refs.

Presents all currently available data for Canadian-grown Douglas Fir poles, from which safe allowable stresses are determined, so that comparisons with other species in use may be made and the resulting data may serve as a basis for more economical pole design.

4987. SALLENAVE, P. Supports de lignes haute tension en bois. **[Wooden supports for high-tension lines.]** *Bois For. Trop.* No. 70, 1960 (57–64). [F.e.span.]

Until recently, high-tension lines (32 to 220 kV) have been supported in France by towers or gantries of assembled steel girders. Reinforced concrete has been widely used for medium voltages (450 to 32,000 V), but seldom for high-voltage lines, because the towers are too heavy and liable to damage during transport. Both of these materials, steel and concrete, have exhibited weaknesses in extreme climates, viz. in mountainous regions where heavy hoar-frost is to be expected, and near the sea where the air is a powerful agent of steel corrosion. The "Electricité de France" attempted to use, in 1955, high-voltage (63 kV) line supports made of wood, according to a modern design, in mountains where hoar-frost prevails. Poles are 15 to 16 m. in height and of Spruce creosoted to the heartwood. Cross-pieces and braces are made of Azobé. The excellent results obtained with this new technique have led the E.D.F. to install three mountain lines and one seaboard line with wooden supports. Another line, at a much higher voltage (220 kV), was equipped with wooden supports in 1959, in the Lozère district. *From author's summary.*

4988. **Sawn house stumps [house posts], sole plates, fence posts and struts from south-eastern Australian hardwoods.** *Aust. Stand.* No. 0.70, 1958. pp. 7. P.R.

832. Mills, Their Functions and Products

See also No. 5021.

832.1. Sawmills and Planing Mills

See also Nos. 4947 *et seq.*

4989. **Australia's largest sawmill in operation.** *Aust. Timb. J.* 26 (2), 1960 (82 . . . 156).

Presents a detailed description of the organization and operation of the South Australian Woods and Forests Department's new Mt. Gambier State sawmill, the largest in Australia. Details of the associated timber preservation plant are included.

4990. TELFORD, C. J. [revised by MALCOLM, F. B.]. **Small sawmill improvement. Practical pointers to field agencies. Sawmill conveyor.** *Rep. U.S. For. Prod. Lab., Madison* No. 899–21 (rev.) 1958. pp. [2]. P.R.

The report (first issued in 1944) describes a simple trough type of chain conveyor designed for carrying sawdust, edgings and timber away from the mill, and discusses optimum conditions of operation.

4991. MATER, M. H. **Automation in medium and small sawmills.** *Unasylva* 13 (4), 1959 (184–7).

The development of sawmill-automation machinery "packages" has made the change to automation a practical investment for medium and small mills. The equipment described, most of which can be added progressively to that already in use, includes log decks, log carriages and headrig, offbearers [conveyor belts], edgers, trimmers and lumber sorters.

4992. NEWPORT, C. A., and LEACH, J. A **method for the application of change-in-grade factors to individual logs—an IBM 650 program.** *Tech. Pap. Pacif. Sthwest. For. Range Exp. Sta.* No. 41, 1959. pp. 9.

Presents a method of computing, for a given log, the total volume of surfaced dry lumber recoverable; the volume recoverable in each grade; value in any given price situation; value per unit volume in dollars per 1000 bd. ft. Data required for programming are: the rough green lumber grade and volume; a table of conversion factors (example given) which must be prepared to indicate the change in grade that will occur during processing from green to surfaced dry timber; the prices of the various lumber grades. The arithmetic of this method and its application to an IBM 650 electronic computer are described, and programmes for sample input cards appended.

4993. FOBES, E. W. **Yield and value of finished lumber from Western White Pine trees and logs.** *Rep. U.S. For. Prod. Lab., Madison* No. 2163, 1959. pp. 9 + 9 gphs., 14 tbls. P.R.

Gives data and an analysis of a survey of Western White Pine timber harvested from the Clearwater National Forest in northern Idaho. One part of the project was designed to determine the effect of timber manufacturing methods on yield and quality, and particularly the effect of position on the carriage with respect to log defects and taper. The other part sought to determine the effect of the inherent characteristics of logs, trees, timber stand, and logging practices, on the yield and quality of finished timber; data and analyses pertaining to such effects on yield and quality are given.

4994. APPLEFIELD, M. **The marginal sawlog for Southern Yellow Pine.** *Res. Note Tex. For. Serv.* No. 21, 1958. pp. 23.

Reports in detail a study made to determine the dimensions of the 'marginal log' for Southern Pine lumber production, i.e. the log for which costs are equal to returns. The use of residues and small low-grade logs for pulp chip production was taken into account. The simplest method is to prepare curves of total cost by log diameter classes and compare these cost data with the total returns by log diameter classes.

4995. KRAMER, P. R. **The yield of sawmill residue Pine pulp chips by sawlog size.** *Circ. Tex. For. Serv.* No. 56, 1957. pp. 6.

A study of the production of sawmill-residue pulp chips from a medium-sized circular-saw mill, based on 115 logs ca. 16 ft. long, indicated that there is a close relationship between log diameter and chip yield, the smaller logs producing a larger yield of residue chips per unit volume than the large logs. Tables are presented giving: (1) estimated yield of Pine residue pulp chips by mean log diam. and by log rule (Doyle, Scribner, and International ¼-inch); (2) estimated yield and value of Pine residue pulp chips by mean log diam. and bd.-ft. lumber tally.

4996. CHILDS, M. R. **A method for estimating residue Pine pulp chip yields.** *Circ. Tex. For. Serv.* No. 59, 1957. pp. 9.

Four medium-sized Pine sawmills were sampled, and the data compared with those obtained in the original study [see preceding abstract]. The results confirm the accuracy of the yield data already obtained, which have been formulated into regression curves. These curves describe the change in chip yield that accompanies a given change in mean log diameter.

4997. GORDON, A., HAIGHT, R., and ZAI, L. **Quality control in a medium size sawmill.** *Tech. Note Univ. Me. For. Dep.* No. 50, 1960. pp. 4.

The feasibility of quality control was explored by (1) determining the principal causes of variation in thickness of lumber produced, and (2) statistical analysis of such variation.

832.2. Veneer and Plywood Mills, including the Manufacture of Composite-Wood Assemblies

See also Nos. 4399, 4832–3, 4875–6, 4965–8, 4970–4, 5010, 5012, 5019.

4998. SCHULZ, H. Untersuchungen über Bewertung und Gütemerkmale des Eichenholzes aus verschiedenen Wuchsgebieten. **[Valuation and quality criteria of Oak wood from various growth regions.]** *SchrReihe Forstl. Fak. Univ. Göttingen* No. 23, 1959. pp. 90. 52 refs. [G.g.]

A detailed study, based chiefly on stems from N. and W. Germany, aimed at finding objective criteria for differentiating between "mild" (highly priced) and "hard" (less valuable) Oak wood. Nearly all the highly priced Oaks were 200 years old or more, while the mean age of the "hard" Oaks was 115 years. For comparable ages (including the earlier-grown parts of older trees) there was little difference between veneer and non-veneer quality in mean ring width, uniformity of growth, early wood %, density, relative proportion of tissues, bark characters, or sapwood thickness, though the best quality was expected to be narrow-ringed and uniformly grown. Veneer Oaks (i.e. old trees) generally contained more wood of a lower density, as density tended to decrease from pith to bark, but the wood at the centre was generally not less dense than that in younger trees. It was, however, less tough and showed a cleaner break than wood of the same density in younger trees. Apart from size (diameter and length of bolt), colour was the most important factor in assessing price. Wood of the best, light, uniform colour was only found in old trees, but no microscopic changes in the cell-wall were observed that could account for changes in toughness, nor any in tannin or Fe content to account for changes in colour. The desired properties appeared to be a concomitant of physiological age, which may set in early or late in the life of an individual (and hence may not be found in some very old trees), and are often associated with visible signs of ageing, e.g. dieback or rot. Because their relation to site factors and tending is not clear, it is difficult to predict whether younger stands will ever reach veneer quality.

4999. SCHULZ, H. Der Phänotyp von Furniereichen und die Beziehungen zur Holzfarbe. **[The relations between phenotype and wood colour in veneer Oaks.]** *Allg. Forstzeitschr.* 14 (50), 1959 (866–9). 3 refs. [G.g.]

Of 22 trees from stands in the Palatinate aged 250 years, varying widely in diameter, crown size, and condition, the most vigorous trees had the poorest wood colour. Good colour was frequently associated with small crowns, horizontal dead branches, large calluses, etc. suggesting that the trees in question once had wider crowns—possibly because they were growing in an open natural stand or in coppice with standards—and had become crowded after the stand had been converted to closed high forest (e.g. by allowing Beech to grow up). It is tentatively suggested that such a disturbed life history may have accelerated the process of physiological ageing on which veneer quality depends and that the present method of growing Oak in carefully tended, close stands may retard the process. [Cf. preceding abstract.]

5000. **Veneer cutting and drying properties. Tanoak [*Lithocarpus densiflorus*].** *Rep. U.S. For. Prod. Lab., Madison* No. 1766–15, 1959. pp. 9 + 4 tbls. 14 refs. P.R.

Tanoak has the necessary properties for use as face veneer when cut $\not> \frac{1}{16}$in. thick. Of attractive colour, some of the sliced veneer has good figure, while rotary-cut veneer resembles quarter-sawn White Oak. Sapwood veneer $\frac{1}{8}$ in. thick appears suitable for veneer strip flooring or plywood block flooring. The species is probably best adapted to rotary veneer cutting [cf. *F.A.* 19 No. 2378]. Methods of preparing the flitches are briefly described.

5001. GEORGE, J., and JOSHI, H. C. **Paper Mulberry (*Broussonetia papyrifera*) as a composite wood timber.** *Comp. Wood* 5 (5/6), 1958 (67–71). 7 refs. P.R.

Investigates the preparation and testing of (*a*) plywood, (*b*) laminated wood, (*c*) compreg, (*d*) paper-overlaid veneer and (*e*) hardboards from *B. papyrifera.* (*a*) Glue-adhesion test results (tabulated in detail) show good gluing characteristics for both urea-formaldehyde and phenol-formaldehyde, the tensile strengths obtained being particularly high, viz. 648 kg./sq. cm. $\parallel$ and 407 kg./sq. cm. $\perp$ vs. the Indian Standards Institute requirements for marine plywood of 420 and 280 kg./sq. cm. respectively. (*b*) and (*c*) Tabulated and graphical data on the strength properties of laminated and compregnated wood from 0·75-mm. sliced veneers, indicate a decrease in tensile, impact and shear strengths as compared with solid wood, due probably to the cutting of fibres that are fairly interlocked in the solid wood. (*d*) The results of comparative tests on 3-mm.-thick overlaid veneers (using phenolic-resin-impregnated kraft paper) and solid wood controls indicated the following strength increases for the former: tensile strength (t.s.) along grain, 22·4%; t.s. across grain 318·2%; modulus of rupture (m.r.) 31·0%. (*e*) The m.r. of boards made from pulp from untreated chips was satisfactory, water resistance and strength being increased both by heat treatment (at 160–170° C. for 5 hours) and by tempering in Cashew shell oil.

5002. NEWALL, R. J. **A survey of methods for assessing veneer quality.** Forest Products Research Laboratory, Princes Risborough. 1960. pp. [2] + 7. 16 refs. Limited distribution. P.R.

The methods, summarized from the literature, are grouped under the following heads: (i) Profile measurement (with (*a*) stylus or similar tracer, and (*b*) shadowline or shadow section); (ii) Staining to indicate lathe checks; (iii) Bending across grain; (iv) Tensile test $\perp$; (v) Contact and tumbling angles of water drops; (vi) The "droop" method developed at Princes Risborough; and (vii) Comparison of numerical and subjective methods.

5003. HRULEV, V. M. O rasčetnyh harakteristikah fanery pri rastjaženii i sžatii. **[The rated**

characteristics of plywood in tension and compression.] *Derev. Prom.* 8 (12), 1959 (14–6). 5 refs. [Russ.] P.R.

The author considers the use of theoretically derived formulae for calculating the tensile and compressive strengths (t.s. and c.s.) of plywood to be practicable only within narrow limits. In order to study the effects of different prolonged temperatures and moisture factors on these strength values, 4- and 7-mm.-thick samples of 3- and 5-ply material were subjected to the following treatments for two years: (*a*) continuous wetting in water at room temperature; (*b*) alternate wetting and drying; (*c*) exposure to outdoor conditions. The largest decrease in t.s. (along the grain of the face plies) occurred after (*b*), and in c.s., after (*c*). After two years, the mean c.s. value was 37% of the original, a higher mean t.s. (along the grain) being observed for (*c*), viz. 43% of original. It should be noticed that t.s. decreased far less in samples of cross-grain face plies than for those along the grain, the outer plies protecting the inner layers from the various destructive factors involved. In all the prolonged tests, weakening of the glue joints affected strength, and the fact that the t.s. of plywood at an angle of 45° decreased twice as much for (*b*) as for (*a*) is largely due to the greater weakening of the glue lines under those conditions. The main defect in rotary-cut veneer materially affecting plywood t.s. is cuts across the grain caused by faulty centring of the veneer bolt. It was found that, if veneer width was sufficient (200–300 mm.) and the fibres were cut across the whole width, veneer strength decreased to $\frac{1}{3}$–$\frac{2}{7}$ that of sliced veneer. The accuracy of estimating the influence of veneer defects and of variable temperature and moisture factors on plywood durability was satisfactorily confirmed by the correlation of experimental and theoretical data. It was concluded that, to lessen this influence, the water resistance of the glue joints should be improved.

5004. JAYNE, B. A. **A non-destructive test for wood laminates.** *Bulletin, Washington State Institute of Technology, Pullman* No. 246, 1959. pp. 66. 46 refs. P.R.

[Cf. *F.A.* 15 Nos. 2837–8.] To determine the suitability of a flexural vibration test as a measure of glue-bond quality in laminated wood, *Juglans nigra* laminates were tested non-destructively in vibration, and destructively by means of conventional static test methods. Accurate measurement of the resonant characteristics of the material was possible through the use of an electrical-acoustical system for exciting, detecting, and measuring vibration, four types of defective glue line of varying extent and location, in specially prepared laminates with matched non-defective controls, being studied. Consistent detection of defects was possible, down to a size of 12% of the entire laminate length, by comparison of second harmonic logarithmic decrements of defective laminates with their individual matched controls. It was also possible, by studying the resonant characteristics of the same laminates at higher harmonic frequencies, to resolve glue-line defects as small as 6% of the laminate length by utilizing the data obtained at all harmonics. In addition it was shown that the latter defects could be detected at any one of 8 positions along the length of a laminate by comparing values of logarithmic decrement at several harmonic frequencies with matched controls. A "before-and-after" vibrational test technique for evaluation of the bond quality of laminated members may prove highly satisfactory for the resolution of glue-line defects measuring $< 6\%$ of the laminate length, and the initial phase of this method, involving the testing of individual laminae before gluing, could be used to control the quality of material used for the final laminated member, while also serving as a basis for comparison with the glued member. The logarithmic decrement of the laminate, when compared with values of the decrement of the laminations, would be employed as a measure of glue-line quality. *From author's summary.*

5005. HUDSON, W. M. **The effect of initial bending on the strength of curved laminated timber beams.** *Wood* 25 (6), 1960 (234–6). 3 refs

Tests on curved laminated beams made from Scots Pine, Sitka Spruce and Larch showed that, while the modulus of elasticity (E) is unaffected by the initial bending of the laminae, the strength of curved beams decreases as the ratio of lamina thickness to their radius of curvature (t/R) is increased. No significant difference was indicated in the effect of initial bending between the three species tested. At $t/R < 0{\cdot}008$, the mean reduction in strength that occurred was greater than that given by a relationship previously derived from tests on other species. The reduction in strength that accompanied an increase in t/R approximated closely to a simple linear relationship with t/R, so that, to obtain a stress value appropriate to the design of a curved beam, the working species and grade should be modified by a factor given by the expression $[1-15\,(t/R)]$.

5006. ENGLAND, R. F. **Progress Report No. E-412–3. Marine laminating properties of selected wood species, Angelique (*Dicorynia guianensis*).** Material Laboratories, Puget Sound Naval Shipyard, Bremerton, Washington. 1959. pp. 4. P.R.

The laminating properties of *D. guianensis* heartwood were investigated, using 3 commercial phenol-resorcinol adhesives. With each glue, satisfactory results [tabulated in detail for the 6 beams tested] were obtained for curing conditions of 150–153° F. for 6 hours (glue-line temperature).

833. Timber in Buildings and Engineering Structures (Manufacture and Use)

5007. **Timber construction manual.** Canadian Institute of Timber Construction, Ottawa. 1959. pp. 368. 2 pp. of refs. P.R.

This 6-part manual is arranged in a form convenient to designers, architects and engineers. Parts I and II present design information (properties, stresses and loads in relation to species groups, sawn timber, glued laminates, etc.); part III contains detailing and estimating data; parts IV and V deal with timber technology (including data on grading and selection, service conditions, dimensional changes in wood, preservative treatments) and reference data (beam diagrams and formulae etc.); part VI gives data on specifications and codes of practice.

833.1. Building Components and Fittings: General

See also Nos. 4838, 4988, 5032–3, 5102–3.

5008. **Interim grading rules for sawn Radiata Pine for use as light framing material.** *Inter. Specif. Stand. Ass. Aust.* No. 377, 1959. pp. 5. P.R.

5009. **Interim grading rules for sawn Radiata Pine for structural engineering applications.** *Inter. Specif. Stand. Ass. Aust.* No. 376, 1959. pp. 7. P.R.

5010. Radcliffe, B. M., Sliker, A. W., and Luebs, D. F. **Nail-glued wood-plywood beams for residential construction.** *Quart. Bull. Mich. Agric. Exp. Sta.* 42 (3), 1960 (584–95). 13 refs.

An investigation was made of nail-glued wood/plywood girders with an I-shaped cross-section. Douglas Fir plywood was used for the web member, and Douglas Fir and White Fir timber for flanges and stiffeners. Load-carrying capacities of the beams tested were found to be limited by allowable deflection or bearing strength of the beams at their supports rather than by shear or bending stresses. Calculated shear stresses at a deflection equal to 1/360 of span, exceeded in some cases those normally allowed for in design. However, no shear failures occurred in any of the girders tested. It was concluded that the current allowable shear stresses are far too conservative. A further investigation was made to determine the effect on strength and stiffness of the girders of removing panels of plywood at various places in the span. It was found that the consequent deflection could be computed as a % of the deflection of beams without panels removed.

5011. Prontuario para el cálculo de los elementos de cubiertas tipificadas de madera. **[Handbook for the calculation of the [structural] elements of typical wooden roofs.]** Servicio de la Madera, Ministerios de Industria y Agricultura, Madrid. [1959?] pp. 182 + 25 dgms. [Span.] I.F.B.

Presents, with many diagrams and tables, all information necessary for calculations connected with the construction of a number of wooden roofs considered to be of "typical" design.

5012. Childs, M. R. **Progress report on temperature tests on wood in frame buildings.** *Res. Note Tex. For. Serv.* No. 24, 1960. pp. 7.

As part of an investigation on the reaction of glues and glued materials to environmental factors, a study was made to determine the location and duration of the highest temperatures existing within the structural members of a wood-frame house in E. Texas during the summer months. Information is presented on daily max. temperatures, number of days on which temperature exceeded 100° F. for any given location, and the duration in hours for which temperature remained $> 100°$ F.

5013. Verrall, A. F. **Preventing moisture problems in wood sidings in the South.** *For. Prod. J.* 10 (3), 1960 (148–51). 5 refs.

Discusses results of exposure tests at Saucier, Mississippi, with various patterns of Southern Pine sapwood sidings, including different sheathings, and fungicidal and moisture-repellent treatments, and makes recommendations on building and treatment methods suitable for the Gulf states. [Cf. *F.A.* 18 No. 2216; 20 No. 1141.]

833.2. Special Uses in Residential, Commercial and Public Buildings

5014. Bryrup, J., *et al.* Træ i sommerhuse. **[Wood in summer dwelling houses.]** [*Publication*] *Træbranchens Oplysningsråd, København* Træ No. 7, 1959. pp. 26. 9 refs. [Dan.e.] P.R.

Describes the various stages in erecting a wooden-framed house for summer use in Denmark, with working drawings, instructions for use of insulation, wood preservation, etc.

834. Shingles. Cooperage. Packing Containers. (Manufacture and Use)

See also No. 5039.

5015. Findlay, W. P. K. **Timbers used by brewers.** *Repr.* from *Journal of the Institute of Brewing, London* 65 (5), 1959 (405–9). 4 refs. P.R.

[Cf. *F.A.* 20 No. 2437.] The main requirements in timbers for vats and casks include: (*a*) impermeability to liquids; (*b*) resistance to fungal decay; (*c*) resistance to chemical attack; (*d*) freedom from tainting; and (*e*) dimensional stability on wetting and drying. Of these, (*a*) is the most important and reaches a high level in the White Oaks. European and U.S. sources have recently been supplemented by supplies from Persia, though some samples from this source have proved unsuitable, instances of beer-tainting being observed following the growth of *Stereum subpileatum.* This danger, however, is removable by steam treatment. The merits of other timbers, such as Kauri Pine, Douglas Fir, and Japanese Oak, and of various laminated and plywood casks, are discussed, and the problem of *Merulius lacrymans* control briefly examined. Methods of insecticidal control of various wood-borers and termites are mentioned.

5016. **Nailed and lock-corner wood boxes.** *Rep. U.S. For. Prod. Lab., Madison* No. 2129, 1958. pp. 30 + 6 tbls., 4 sets of dgms., 4 gphs., 3 photos, 3 drawings. P.R.

Presents the principles of efficient design for nailed and lock-corner wood boxes, based on extensive investigations at Madison and supplemented by studies and observations of boxes in service during World Wars I and II. Included are sections dealing with the quality and species of timber used, nailing properties of wood, the corrosion of metals in contact with wood, and preservative treatments.

5017. McBirney, S. W. **Harvesting apples with pallet bins in the Pacific Northwest.** *For. Prod. J.* 10 (4), 1960 (196–9). 17 refs.

Discusses the very great reduction in quantity and changes in the types of wood required as a result of the tendency of fruit growers in the U.S.A. to replace the usual bushel boxes by fibre cartons for shipping and by strong wooden bins holding 25–27 bushels for picking and cold storing.

835. Industrial and Domestic (Utility) Woodware. Toys and Models. Sports and Recreational Goods. Musical, Scientific and Mathematical Instruments. Surgical Applications etc.

See also No. 5099.

5018. Edwards, M. G. **Pencil slats.** *Extr.* from *Annual Report, East African Industrial Research Board, Nairobi 1958/59*, 1959 (5). P.R.

Reports on an investigation made on behalf of a sawmill producing Cedar-wood pencil slats, in which the problem of dyeing the slats with complete penetration was solved by utilizing part of the slat treatment, which consists of impregnating with paraffin wax. The process involved immersing the slats in a solution of 0·25% Waxoline Red dye in paraffin wax at 130° C., then applying a high vacuum for 30 min. followed by a pressure of 50 lb./sq. in. for 2 hours.

838. Vehicles (including Ships, Boats, Aircraft)

See also No. 5006.

5019. Newall, R. J., and Doman, L. S. **Investigation into glues and gluing. Progress report 119—Oct. 1959. Behaviour of glued wood products in light naval craft. Ten years' analysis [superseding all previous reports].** Forest Products Research Laboratory, Princes Risborough. 1959. pp. 61. Limited distribution. P.R.

A brief outline of the history of the work since 1949, details of planning and preparation of test material, and detailed reports of inspections, tests and results.

839.1. Wood Wool and its Manufacture

5020. Wacker, H. Holzwolle und Holzwollemaschinen. **[Wood wool and machines for making it.]** *Holz Roh- u. Werkstoff* 18 (4), 1960 (142–52). 3 refs. [G.g.e.] P.R.

839.8. Industrial Waste Wood, its Processing and Uses

See also Nos. 4315–6, 4354, 4359, 4995–6, 5088, 5108.

5021. Svjatkov, S. N., and Štennikova, N. A. O rasčete ustanovok pnevmatičeskogo transporta s dvumja ventiljatorami. **[Calculating the lay-out of a two-fan pneumatic conveyor.]** *Derev. Prom.* 9 (3), 1960 (12–3). [Russ.] P.R.

A theoretical examination of the problems involved in using a pneumatic conveyor equipped with two suction fans in series, for transporting comminuted wood. Equations are presented indicating the necessary air speeds and pressures required, and suggestions are made for unifying the work of the fans so that each covers ½ the total pressure losses in the system.

5022. Millstein, H., and Mørkved, K. Briketteering av bark og sagflis. **[Briquetting of bark and sawdust.]** *Norsk Skogind.* 14 (5), 1960 (182–94). 17 refs. [Nor.nor.e.] P.R.

In laboratory-scale tests, briquettes were made from Pine or Spruce sawdust with or without a binder (5% ground Spruce bark or 2% sulphite liquor) or from Spruce bark alone, at varying temperatures and moisture contents, but constant pressure. Quality (resistance to wear and crumbling, expressed as a % by weight of the initial weight, after tumbling in a rotating drum) increased with increasing temperature in the range 20–100° C., up to 15–16% m.c., the optimum m.c. being 8–10%. The binders had little effect at low m.c. but their use considerably improved quality at 15% m.c. Quality of Spruce bark briquettes was high for most of the temperatures tested, and tended to increase with increasing m.c. up to 23·5%. A method is described of preparing Pine or Spruce bark, with m.c. up to 50–60%, on a factory scale, by a hammer milling to a particle-size similar to that of sawdust, followed by suspension drying. Quality (here density, crushing strength, and relative weight after testing in a rotating drum) of briquettes of sawdust or bark, made on a factory scale, is shown in graphs. Briquettes of Spruce bark were of very high quality and Spruce bark added to sawdust proved an efficient binder. Briquettes of Pine bark were of poorer quality, but briquettes of sawdust mixed with Pine bark were of similar quality to those of sawdust alone. Power consumption in briquetting was slightly lower for bark than for sawdust.

84. Preservation and Other Treatments to Improve the Properties of Wood. Damage by Biological Agencies and its Control. Seasoning. Timberyard Practice

841. Wood Preservation

See also Nos. 4832, 4838, 4989, 5013–4, 5051, 5053, 5065–6, 5072–3, 5083, 5128.

5023. **Wood preservation.** *Wood* 25 (6), 1960 (237–56). 5 refs.

Nine papers on: wood preservation and standardization; timber and fire retardants; structural timbers; creosote as a wood preservative; water-repellent wood preservatives; diffusion impregnation of light building timbers; termites and their control; agricultural and horticultural uses; and international co-operation in preservation.

5024. Ribeiro, S. F. Pereira. Fundamentos da preservação de madeiras. **[Wood preservation: basic information.]** *Estud. Inform. Serv. Flor. Aqüic. Portugal* No. 118–*E5*, 1960. pp. 30 + 4 plates. 11 refs. [Port.] Limited distribution.

Presents summarized information on: (1) the most important wood destroyers of Portugal, i.e. marine and terrestrial borers, termites and fungi; (2) methods of combating them; (3) standard laboratory methods used in testing products for the preservation and protection of wood; and (4) brief notes on field tests.

5025. MOLDRUP, N. Træbeskyttelse. **[Wood preservation.]** [*Publication*] *Træbranchens Oplysningsråd, København* Træ No. 4, 1958. pp. 24 + [3]. [Dan.e.] P.R.

Describes methods of surface application and impregnation, lists various types of preservative with notes on their uses and properties, and presents data on quantities needed, labour costs, and, for some 30 preservatives, properties in use, and cost of the preservative.

5026. ZENKER, R. Untersuchungen über das Dynstat-Holzschutzmittel-Kurzprüfverfahren. **[The Dynstat rapid test for wood preservatives.]** *Arch. Forstw.* 9 (2), 1960 (172–93). 4 refs. [G.g.russ.e.]

Describes further trials of this static-bending test [cf. *F.A.* 17 No. 3376] in order to find the most suitable test pieces and to compare its accuracy with that of the standard weight-loss test (DIN 52 176). Wood with narrow rings gave more uniform values than wood with normal or wide rings, and test specimens with rings ∥ or at an oblique angle to the broad face were preferable to specimens with rings ⊥ because of their greater strength losses during the short period of exposure. Though strength values showed 2–4 times the scatter, so that the method cannot replace the more accurate weight-loss method, there was good correspondence of tolerance limits for 1 oily and 4 aqueous preservatives (except where the specimens had been leached after impregnation) with a similar scatter of values, and the usefulness of the method has been confirmed.

5027. BAECHLER, R. H. **Determining preservative retention in piling by the assay of borings.** *Rep. U.S. For. Prod. Lab., Madison* No. 2172, 1959. pp. 7 + 3 tbls., 1 photo. 2 refs. P.R.

5028. WILSON, W. J. **The determination of arsenic in treated wood.** *Analytica Chimica Acta, Amsterdam* 22 (1), 1960 (96–100). 9 refs. [E.e.f.g.] O.R.S.

A modification of the Schulek and von Villecz method for the determination of arsenic in organic compounds was applied with good results to the determination of arsenic in wood. The presence of Cu and Cr did not cause interference.

5029. KOWALSKA, E. Impregnacja drewną droga wytwarzania fluorokrzemianu sodu wewnątrz komórek drewna. **[Impregnation of wood by the formation of Na_2SiF_6 inside the wood cells.]** *Przemysł Chemiczny, Warszawa* 37 (6), 1958 (421–4). 8 refs. [Pol.pol.russ.*e*.] L.S.

The method described [cf. *F.A.* 20 No. 5259] involved the impregnation of Pine [*Pinus sylvestris*?] sapwood samples with NaCl and then with H_2SiF_6 solution, this double saturation being found by X-ray examination to produce poorly soluble Na_2SiF_6 in the wood cells. Detailed tabulated results showing the range of fungicidal activity against *Coniophora cerebella* are presented for leached and unleached impregnated samples, and an examination of the corrosive action of NaCl and H_2SiF_6 on steel was also made. The treatment is claimed to be considerably cheaper than that using the commercial solution "Fluralsil".

5030. KALNIŅS, A., STREIPA, P., and ERMUŠ, N. **Chlorinated wood resin used as an antiseptic under field conditions.** *Trud. Inst. Lesohoz. Probl., Riga* No. 17, 1959 (133–8). [Russ.?] From *abstr.* in *Chem. Abstr.* 54 (9), 1960 (9189). P.R.

Describes field experiments lasting 2–4 years, in which wood blocks (4 × 6 × 140, and 8 × 12 × 150 cm.) cut from a 40-year Pine were impregnated with chlorinated (coniferous) resins for fungus control. The resins retained their fungicidal properties for a long time and favoured the formation of a hydrophobic film on the surface of the treated wood, which protected it from humidity. In view of their ease of production, their use is recommended for impregnating telegraph poles and house timbers.

5031. **Wood preservation with penta-creosote solutions.** Monsanto Chemical Co., St. Louis, Miss. 1960. pp. 7. 6 refs. P.R.

Tabulates data showing the greatly increased toxicity achieved against a wide range of wood-destroying fungi and marine borers by incorporating small amounts of PCP in creosote before treating Southern Pine poles.

5032. Technische Vorschriften für Holzschutzarbeiten. **[Technical rules for wood preservation work.]** *Holz-Zbl.* 86 (72/73), 1960 (1007). [G.]

Reprints the rules issued for the protection or disinfestation from insects, of wood in buildings, by the German Working Party for Wood Conservation —Quality standard [Holzschutz-Güteschutz] supplementing *DIN* Nos. 52 175 and 68 800.

5033. DENSHAM-BOOTH, D. F. **The preservative treatment of constructional timbers in Malaya.** *Roy. Engrs'. J.* 74 (2), 1960 (166–77 + 1 dgm.). Also in *Malay. Forester* 23 (2), 1960 (98–107).

Describes the author's personal experiences in perfecting an economic method of preserving Malayan timbers by the dual-bath open-tank system. The principles involved are equally applicable to the treatment of timbers in other parts of the world, and the method of impregnation described (hot and cold soaking, using two tanks) is equally suited to field or commercial application.

5034. BARNACLE, J. E. **A marine borer test in Australian waters.** *For. Prod. Newslett. C.S.I.R.O. Aust.* No. 262, 1960 (1–3).

The continued strain on the supply of Australia's traditional marine-piling timbers, *Tristania suaveolens* and *Syncarpia laurifolia*, has led to a test on other timbers in Sydney harbour, on the Brisbane river and at sites in W. Australia, for resistance to *Teredo* and *Sphaeroma* attack. Sawn *Pinus radiata* specimens (30 × 3 × 2 in.) and natural rounds of *Eucalyptus macrorrhyncha* (30 in. long, 3–5 in. diam.) were pressure-impregnated with 5 oil- and 6 water-borne preservatives, and immersed at depths of maximum marine-borer hazard in Oct.–Nov. 1959. An inspection at the Brisbane site after 3 months' immersion showed no sign of attack in the treated specimens, whereas untreated controls of the same species and of *E. marginata* had been heavily attacked. The first comprehensive test inspection is planned for June 1960.

5035. Lohwag, K. Mastenschaftschutz. **[Protection for [the above-ground part of] transmission poles.]** *Holz-Kurier, Wien* 15 (17), 1960 (10). [G.]

Describes a device for the treatment of standing poles against *Hylotrupes bajulus*, developed by the power authority of Swabia where attacks of *H. bajulus* on insufficiently treated poles had increased [cf. *F.A.* 19 No. 1067]. The inventors use 3–4 kg. of Xylamon per pole and treat 60–100 poles per day.

5036. Englerth, G. H. **Preservation of Puerto Rican fence posts treated by cold soaking and the hot-and-cold bath method.** *Trop. For. Note Trop. For. Res. Cent., Río Piedras* No. 2, 1960. pp. 2 + 2 dgms.

Summarizes information obtained in a study made in 1958 on the treatability of 83 non-durable Puerto Rican timbers, 52 species being treated by cold soaking with 5% PCP in diesel oil, 21 by the hot-and-cold bath method with 5% PCP, and 10 by both methods with a 50/50 creosote and diesel oil solution. The service life for all the species is being determined by field tests.

5037. Halank, E. **The impregnation of timber sleepers.** *Transl. Commonw. Sci. Industr. Res. Organ. Aust.* No. 4534, 1959. pp. 15 + 5 photos, 2 drawings, 4 sets of dgms., 3 gphs. Transl. by E. Pichler from *Holzschwelle* 1959 (29), (1–23).

Examines the costs and merits of impregnating sleepers with various oils, and oil- and water-soluble preservatives, for insect and fungus control.

5038. Courtois, H. Holzschutz an Offenstallbauten. **[Wood preservation in open cattle sheds.]** *Deutsche Agrartechnik* 8 (12), 1958 (544–6). [G.] I.M.I.

Brief practical instructions as to which timbers should and should not be treated, with recommendations as to suitable methods.

5039. Blew, J. O., Jr. **Preservatives for wood pallets.** *Rep. U.S. For. Prod. Lab., Madison* No. 2166, 1959. pp. 7. 8 refs. P.R.

Outlines and examines the main reasons for treating pallets for outdoor and cold-storage uses, viz. (i) decay protection, (ii) cleanliness, so improving appearance and reducing spoilage of food products, and (iii) reduction of defects due to moisture changes, mainly weathering, warping, checking, splitting and nail-popping. Seven common commercial waterborne preservatives are listed as being particularly suitable for the above purposes.

842. Treatments to Improve the Resistance of Wood to Physical and Chemical Agencies

See also No. 5023.

5040. Frejdin, A. S. Modifikacija svojstv drevesiny s pomošč′ju ionizirujuščih izlučenij. **[Modification of the properties of wood by means of ionizing radiation.]** *Derev. Prom.* 9 (1), 1960 (15–6). 4 refs. [Russ.] P.R.

[Cf. *F.A.* 20 No. 3696.] The method of modification is to impregnate pieces of wood with a monomer (e.g. styrene) and then expose them to ionizing radiation (γ-rays) from a Co^{60} source. This treatment polymerizes the monomer which is within the cells and intercellular spaces, and so changes the properties of the wood. For example, a piece of Scots Pine, containing 120% by weight of styrene and treated at 2·2 rad./sec. until it had received a dose of 15·5 megarads, acquired a compression strength || of 920, and a static bending strength of 1400 kg./sq. cm. vs. only 325 and 345 [*sic* (also given as 845 in another paper; see following abstract)] kg./sq. cm. respectively. The possibilities are outlined of modifying the fungus resistance, strength, dimensional stability, etc. of wood and wood-based materials as required. This method of modification could be utilized, e.g. in making moulds for foundry work, and for preserving archaeological specimens. Some data are also given on the effects of radiation on synthetic phenol and urea glues.

5041. Karpov, V. L., *et al.* **Radiation makes better woods and copolymers.** *Nucleonics, New York* 18 (3), 1960 (88–90). O.R.S.

Describes a method of improving the properties of wood. A monomer is inserted into the wood by impregnation and subsequently polymerized by radiation. [See preceding abstract.]

5042. Solechnik, N. Ya. [Solečnik, N. Ja], and Novosel′skaya [Novosel′skaja], A. I. **Impregnation of wood with condensation products of phenol and formaldehyde.** *Naučnye Doklady Vysšej Školy, Lesoinženernoe Delo* No. 1, 1959 (245–50). [Russ.] From *abstr.* in *Chem. Abstr.* 54 (9), 1960 (9284). P.R.

Small samples of Pine (*a*) were treated with condensation products of C_6H_5OH and HCHO (1) and resorcinol (2). Containers with wood cut into small cubes were evacuated, (1) was added at 6–8 mm. Hg, and the temperature raised first to 105, and then for 7 min. to 160° C. To decrease the temperature necessary for polymerization, (2) at 2·5 and 20% was added, in the presence of which treatment was carried out at 70° for 120 hours, the 2·5% addition imparting a higher dimensional stability to the wood than the 20% addition (evidently because of rapid polymerization in the latter case). Larger samples (4·8 × 4·8 × 15 cm.) (*b*) were immersed in a 10% solution of (1), evacuated for 1 hour, and then subjected to pressure of 12 atm. for 25 hours. Increases in sp. vol. of (*a*) 15% and (*b*) 6·6% occurred; untreated samples sorbed 169, and treated, 135–137% water; linear extension of untreated samples was 2·6, of treated 1·4%; tangential extension of the former was 5·4, of the latter 3·7%. Bending resistance was increased by 11–25%.

5043. Narayanamurti, D., and Kaul, R. K. **Heat stabilized compressed wood from Indian species and factors affecting improvement in properties. (At the same time studies in improved wood: Part IX.)** *Comp. Wood* 5 (5/6), 1958 (71–6). 1 ref. P.R.

[Cf. *F.A.* 17 No. 944.] Presents results of experiments with *Abies pindrow*, *Cedrus deodara*, *Picea morinda* and *Pinus excelsa* rotary-cut veneers. Strength properties are graphed for veneer thickness of $\frac{1}{8}$, $\frac{1}{16}$, $\frac{1}{32}$, $\frac{1}{64}$ and $\frac{1}{100}$ in., after treatment at 10° intervals from 120 to 190° C. and at pressures of 200, 600, 1000 and 2000 lb./sq. in. (mean moisture content of material 18%).

5044. Goldstein, I. S., *et al.* **Wood processing. Inhibiting against swelling and decay.** *Industr. Engng. Chem.* 51 (10), 1959 (1313–7, 15*A*). 16 refs. O.R.S.

When *Pinus ponderosa* wood was impregnated with phenol-formaldehyde resins of various ages which were then further polymerized, the reductions in swelling of the treated wood were found to be related to the methylolphenols content of aged resin solutions. Tests on *P. ponderosa* and *P. echinata* showed that if the hydroxyl groups of wood cellulose are replaced by ether or ester groups, the wood does not absorb as much moisture and does not swell as much as untreated wood. β-Propiolactone reacts to form graft polymers on the cellulose chains which reduce the swelling of the wood by as much as 70%. Cyanoethylation also substantially reduced this swelling. Both kinds of modified wood were found to resist attack by 4 species of wood-destroying fungi (*Lentinus lepideus*, *Lenzites trabea*, *Poria monticola*, and *Coniophora puteana*). *From authors' summary.*

843. Fireproofing and Fire Resistance

See also Nos. 4884, 5023.

5045. **[Fire-proofing of wood and wood-based materials.]** *Wood Ind., Tokyo* 15 (4), 1960. pp. 58. Many refs. [Jap.] P.R.

The issue consists of 13 review articles by different Japanese authors, dealing with the combustibility of wood, the mechanism of fire, and various aspects of fire-proofing and fire-retardant treatments of wood, plywood, hardboard etc. (English titles listed.)

5046. Linacre, E. T., and Jones, D. H. **The heat-protection of timber by silicate-based coatings.** *Research Report, Safety in Mines Research Establishment, Sheffield* No. 178, 1959. pp. 18. 19 refs. P.R.

Describes a procedure for assessing the heat-protection afforded to timber (mainly Scots Pine) by compounds of Na silicate, limestone dust and sand, under conditions simulating a mine-roadway fire, and discusses the effects of damp conditions, and exposure to fires of different intensities, on the fire resistance of boards coated with the various Na silicate compositions.

5047. Drubel, R. B., and Rupprecht, W. E. F. **Latex fire retardant intumescent coatings.** *For. Prod. J.* 10 (3), 1960 (152–5).

Describes formulations to reduce flame spread, designed for application to low-density vegetable or wood fibreboards as part of the manufacturing process. The most useful formulations contained $NH_4H_2PO_4$, dicyandiamide and penta-erythritol as intumescents and a latex binder of the vinyl-chloride/vinylidene-chloride type.

844. Attack by Plant Organisms

844.1. Sap-staining and Mould Fungi

See also Nos. 4082–3, 4585, 5065–6, 5068.

5048. Šarić-Sabadoš, A. Plavilo ležećeg drveta. **[Blue-stain of timber.]** *Zašt. Bilja* No. 47/48, 1958 (223–6). [Serb.e.] I.M.I.

From samples of (*a*) Pine, (*b*) Fir, (*c*) Lime, (*d*) Acacia, and (*e*) *Turraeanthus africanus*, the following fungi were isolated: *Ceratostomella* sp. nov. from (*b*) and (*c*); *Graphium penicilloides* from (*a*), (*b*), and (*e*); *Alternaria humicola* from (*a*); *Fusicoccum tingens* from (*a*), (*b*), (*c*), and (*d*); *Trichoderma lignorum* from (*b*) and (*e*); *Stysanus stremonites* from (*e*). *F. tingens* was the commonest and most serious of these, while *T. lignorum* and *S. stremonites* are of secondary importance. Minimum wood moisture content for growth of *F. tingens* and *Ceratostomella* sp. nov. was 29% in (*b*) and 27% in (*a*) at 20° C. A temperature of 18–30° was found to favour the growth of these and *G. penicilloides* on agar jelly. Within this range the mycelia darkened rapidly. Good growth was found also at 16°, but the mycelia darkened much more slowly, their colour never reaching the intensity that higher temperatures gave. Above 35° and below 2° there was no sign of growth.

5049. Davidson, R. W. **Additional species of Ophiostomaceae from Colorado.** *Mycologia* 50 (5), 1958 (661–70). 10 refs. O.R.S.

Four species have been isolated from dead or injured *Abies lasiocarpa*. Two (*Ceratocystis nigra*, *C. brunnea*) are new species associated with bark-beetle galleries, and two (*C. minor*, *C. penicillata*) are species previously reported as associated with barkbeetles. Three other new species are described from secondary barkbeetles associated with *Dendroctonus engelmanni* in *Picea engelmannii*. These are *C. perfecta*, *C. tenella*, and *C. vesca*. Two species are reported from *Populus tremuloides* sapwood in Colorado for the first time. *C. brevicollis* is a new species associated with ambrosia beetles in Aspen. *From author's summary.*

5050. Wilson, C. L. **Penetration and invasion of *Ceratocystis piceae* in White Oak wood.** *Mycologia* 51 (3), 1959 (311–7). 4 refs. O.R.S.

Reports on a study in stained *Quercus alba* wood adjacent to the galleries of the ambrosia beetle *Corthylus columbianus*. The growth of *C. piceae* was chiefly intracellular and confined primarily to vertical xylem parenchyma and uniseriate-ray cells. The large medullary rays were not invaded. *C. piceae* appears to be able to penetrate *Q. alba* cells only through pits. Penetration of the membrane between simple pit-pairs generally involves the formation of appressoria, whereas the membrane between bordered and half-bordered pit-pairs is penetrated without the formation of such structures. [Cf. *F.A.* 21 No. 764.] *From author's summary.*

5051. Small, D., and Jeffers, J. N. R. **An experiment in the control of blue stain at Thetford Chase, 1957.** *Emp. For. Rev.* 39 (2), 1960 (211–9). 6 refs.

Discusses the lay-out and results of a statistically controlled field experiment using water-soluble fungicides on newly felled *Pinus sylvestris* and *P. nigra* var. *calabrica* logs. Barked and unbarked random lengths with 6 in. top diameter o.b. were treated at 4 localities with 5% solutions of Na pentachlorophenate and Na orthophenyl phenate, and quarter-sawn to analyse degree of sapstain.

Treatments significantly reduced the amount of stain, but not to the degree required by British Grading Rules for Grade-I timber (5% stain). The majority of logs were Grade II (up to 15%). There was no significant effect from species, or any interactions of the sites or treatments; there was, however, a highly significant interaction between the effect of barking and dates of felling, the % of surface stained being less for unbarked logs felled in June and Sept. than for barked, and less for barked logs felled in March than for unbarked.

844.2. Wood-destroying Fungi

See also Nos. 3959, 4440, 4563 *et seq.*, 5015, 5024, 5026, 5044, 5059–60, 5065–6, 5090, 5114.

5052. MEYERS, S. P., and REYNOLDS, E. S. **Effects of wood and wood products on perithecial development by lignicolous marine Ascomycetes.** *Mycologia* 51 (2), 1959 (138–45). 13 refs. O.R.S.

Wood and wood products, incorporated into culture media, were used to stimulate perithecial production. Fertile fructifications were produced in cultures grown on Balsa-wood pieces partly submerged in flasks of yeast-extract broth. Media with powdered cellulose or wood flours, supplemented with 0·1% yeast extract, supported sporulation in certain of the species.

5053. FINDLAY, W. P. K., and SAVORY, J. G. **Dry rot in wood.** *Bull. For. Prod. Res., Lond.* No. 1 (6th ed.) 1960. pp. 35 + 9 photos.

Since the issue of the 5th edition [see *F.A.* 14 No. 783] methods of sterilizing infected walls have been continuously under review. The section dealing with wall sterilization, and those on wood preservatives and building practice, have again been revised, and data on effective new fungicides, particularly since 1957, are included.

5054. WALTERS, N. E. M. **Decay in timber.** *For. Prod. Newslett. C.S.I.R.O. Aust.* No. 260, 1960 (1–4).

Describes briefly the decaying action of the following wood-destroying fungi: *Trametes lilacino-gilva, Coriolus* [*Polystictus*] *sanguineus, Fuscoporia* [*Poria*] *contigua, Polyporus eucalyptorum, Armillaria mellea, Elfvingia* [*Ganoderma*] *applanata, Poria medulla-panis, P. vaillantii,* and *Coniophora* spp.

5055. GILBERTSON, R. L. **Studies on the western wood-rotting fungus *Poria zonata* Bres.** *Canad. J. Bot.* 38 (1), 1960 (87–91). 8 refs. O.R.S.

The fungus is widely distributed in western U.S.A. and British Columbia on recently fallen trees of *Abies grandis, A. concolor, A. lasiocarpa, Larix occidentalis, Pseudotsuga taxifolia* and *Tsuga heterophylla.* A description is given of its sporophores and cultural characteristics and the white pocket rot that it causes.

5056. **Factors that influence the decay of untreated wood in service and comparative decay resistance of different species.** *Rep. U.S. For. Prod. Lab., Madison* No. 68 (rev.) 1958. pp. 6. P.R.

The report (first issued in 1928) discusses the various conditions that have been shown to influence the decay of wood, and classifies 54 common native U.S. species in groups according to the decay resistance of their heartwood.

5057. CAMPBELL, R. N., and CLARK, J. W. **Decay resistance of Baldcypress heartwood.** *For. Prod. J.* 10 (5), 1960 (250–3). 14 refs.

Soil block tests with 4 fungi on samples of *Taxodium distichum* and *T.d.* var. *nutans* taken from 7 tide-water or upland swamps did not bear out the common belief that origin affected decay resistance. Nor was there any close relation between decay resistance and colour in this largely second-growth material, though the single instance of red outer heartwood found (reputedly the best) was in fact highly resistant. Most of the samples could only be classed as resistant (11–24% weight loss) or moderately resistant (25–45% weight loss). There appeared to be a slight tendency for resistance to increase with age, and to be higher in the outer than the inner heartwood.

845. Attack by Animals

See also No. 3959.

845.1. Marine Borers

See also Nos. 5024, 5034.

5058. BECKER, G., and KAMPF, W.-D. Funde der holzzerstörenden Isopodengattung *Limnoria* an der Festlandsküste Indiens and Neubeschreibung von *Limnoria indica.* **[The wood-destroying genus *Limnoria* found on the coast of the Indian mainland, and a description of *L. indica* [sp. nov.].]** *Zeitschrift für angewandte Zoologie, Berlin* 45 (1), 1958 (1–9). 12 refs. [G.g.e.] L.S.

The new species was found in Mandapam and Madras harbours. *L. tripunctata* was also found in Madras harbour, but species of *Limnoria* appear to be scarce in Indian waters, presumably because of the high temperature.

5059. KAMPF, W.-D., BECKER, G., and KOHLMEYER, J. Versuche über das Auffinden und den Befall von Holz durch Larven der Bohrmuschel *Teredo pedicellata* Qutrf. **[The finding of wood by *T. pedicellata* larvae and conditions for its being attacked.]** *Zeitschrift für angewandte Zoologie, Berlin* 46 (3), 1959 (257–83). 29 refs. [G.g.e.] L.S.

In aquarium experiments, tests with various substances, including extracts from Pine wood and from marine fungi, suggested that the swimming larvae were not attracted chemotactically from a distance, but only accidentally landed on surfaces which they then examined with their feet for suitability. Permanent settlement took place only on wood with some fungal growth (marine species of Ascomycetes, Fungi Imperfecti or Basidiomycetes) but not on sterile wood, wood the surface of which had been softened chemically, or wood coated with algae. Since fungi are a pre-condition for larval settlement, research into fungicides having great resistance to leaching and evaporation from superficial layers is recommended. [Cf. *F.A.* 20 No. 5270.] *From authors' summary.*

5060. Kohlmeyer, J., Becker, G., and Kampf, W.-D. Versuche zur Kenntnis der Ernährung der Holzbohrassel *Limnoria tripunctata* und ihre Beziehung zu holzzerstörenden Pilzen. **[The food of *L. tripunctata* and its relation to wood-destroying fungi.]** *Zeitschrift für angewandte Zoologie, Berlin* 46 (4), 1959 (457–89). 49 refs. [G.g.e.] L.S.

In one series of tests in artificial sea-water, the life span of *L. tripunctata* fed on sterilized Pine that had never been attacked by fungi, sterilized filter paper, or cellulose foil, was no longer than that of unfed controls; individuals fed on Pine sapwood infected by fungus, whether alive or killed by boiling or autoclaving, lived longer, and those fed on fungus-free *Helianthus* pith longest. In another series, under slightly different conditions, the life span of *L. tripunctata* on sterile fungus-free wood, both Pine and hardwood, was markedly longer than that of controls. In sterile Beech it probably reached its natural maximum, and fungus infection exercised no further effect, but in Pine the presence of marine fungi and *Pleurotus ostreatus*, alive or dead, but not of brown-rot Basidiomycetes, did increase the life span. Reproduction was observed only in specimens fed on fungus-infected wood. The role of fungi in the nutrition of the *Limnoria* and possible reasons for conflicting experimental results [cf. *F.A.* 20 No. 5269–70; 21 No. 1106] are discussed.

845.2. Terrestrial Borers

See also Nos. 4642, 4675, 4832, 5024, 5032, 5035.

5061. Hector Santoro, F. Fases lunares e insectos que apolillan maderas. **[Lunar phases and wood-boring insects.]** *Foll. téc. for. Adm. Nac. Bosques, B. Aires* No. 1, 1959. pp. 11. 11 refs. [Span.span.]

A brief review of the subject on the basis of data collected at various times by the Dirección de Investigaciones Forestales, giving no support for the theory. Data are presented relating specifically to *Lyctus brunneus*, *L. simplex* and *Xyletinus brasiliensis* var. *argentea*, and showing that boring occurs whatever the phase of moon when trees are felled. [Cf. Beeson, *F.A.* 8 p. 196.]

5062. Wilson, L. F. **Reducing pulpwood losses from borer attacks by shading conventional pulp piles.** *Tech. Note Lake St. For. Exp. Sta.* No. 583, 1960. pp. 2.

In a study to determine whether any method of stacking pulpwood would protect logs from borer attack, (*a*) standard [bulk] stacks of pulpwood and (*b*) modified (more open) pens of 100-in. logs of Balsam Fir and Spruce were placed in a clearing and in the shade under living conifers. Over 95% of insect damage found was caused by *Monochamus scutellatus*. In the clearing, exterior logs in (*a*) averaged 182 larvae and interior logs 19; all logs in (*b*) averaged 182. In the shade, exterior logs in (*a*) averaged 26 larvae, and interior logs 3; logs in (*b*) averaged 16. Logs from the exterior of small supplementary stacks in the clearing averaged 206 for Balsam Fir, and 378 for Spruce. It is recommended that pulpwood be stacked in standard bulk stacks under the shade of standing trees or shaded with fresh boughs, if other preventive measures cannot be undertaken.

5063. Shenfelt, R. D., *et al.* **Spraying Jack Pine pulp logs.** *Agricultural Chemicals, Baltimore* 13 (1), 1958 (38–40). 9 refs. O.W.

An analysis of the results of spraying barked and rough Jack Pine pulp logs with a solution of 12% γ BHC wettable powder to control insect and fungal attack in 1955. Particular attention was paid to pulp yields and the economics of the operation. Results indicate that the operation was economically sound, especially with barked logs, and the practice is being increasingly followed in the Lake States.

5064. **Insect spray at cutting time boosts pulp yield.** *Extr.* from *Rep. Wis. Agric. Exp. Sta.* 1958 (45).

As a result of experiments in the forest, two paper companies using large quantities of Jack Pine now spray all pulpwood cut during the season of bark-beetle activity, or stored in the woods during that period. Each layer of logs is sprayed at a rate of 0·7 oz. of 12% γ BHC per cord. Treated wood yields 2·8% more pulp, representing a net saving of 50 cents/cord. Cutters get 15 cents per cord extra for spraying, the company providing material and equipment.

5065. Silva, F. P. V. de Azevedo e. Subsídios para o estudo da protecção das madeiras em toros no Distrito de Cabinda. **[Protection of logs [in the forest] in the Cabinda District.]** *Agron. angol.* No. 11, 1957/1959 (57–120). 27 refs. [Port.]

Presents the results of preliminary experiments made on the three most important export timbers of Cabinda [Portuguese W. Africa], i.e. Tola Branca (*Gossweilerodendron balsamiferum*), Limba (*Terminalia superba*) and Indianunu or Unidianunu (*Khaya klaineana*). Logs, both barked and unbarked (and in the case of *G. balsamiferum*, also logs stripped of their sapwood), were treated with a number of well known fungicides and insecticides. No single insecticide was fully effective. Those based on γ BHC had the most lasting effect over the period of observation (30 days). These and DDT appeared to give the most complete protection, but the number of tests was not sufficient to warrant a definite statement. Liquid emulsions applied as sprays are recommended. Addition of a fungicide such as PCP (Na salt) (2·5%) to the insecticide is also advisable. No advantage resulted from barking the logs. For *G. balsamiferum*, removing the sapwood was a better protective measure than any chemical treatment. Treatments should be given within 48 hours of felling, and are useless in the rainy season.

5066. **[Studies on the protection of Beech [*Fagus crenata*] green log from insect and fungus attacks.]** *Bull. For. Exp. Sta., Meguro, Tokyo* No. 120, 1960 (1–109 + 6 plates). 58 refs. [Jap.e.]

The issue is devoted entirely to experiments made in 1952–54 by a research group of Japanese entomologists, mycologists and chemists, and is divided into the following main sections: (1) insect control; (2) fungus control; and (3) a discussion of the chemicals tried. Best combined protection was given by sprays of 1–2% γ BHC in combination with 2–5% PCP or 15–30% creosote.

5067. MAKSIMOVIĆ, M. Ogledi suzbijanja sipaca drvenara na stovarištima hrastovih trupaca. **[Experiments in control of Ipidae and Platypodidae in Oak-log timberyards.]** *Zašt. Bilja* No. 51, 1959 (3–13). 8 refs. [Serb.serb.e.*e.*] I.M.I.

To protect Oak logs in timberyards at Sremska Mitrovica against heavy damage from *Xyleborus monographus*, *Platypus cylindrus* and *Anisandrus dispar*, various powders and liquids based on BHC and γ BHC were tested. Best results (saving 97·5–99·1% of the damage done to control logs) were achieved with a 0·3% γ BHC oil emulsion, and its use is recommended.

5068. BAKKE, A. Ved sprøyting av tømmer kan en drepe insekter som er årsak til markhull og blåved. **[Log spraying can be used to kill insects causing worm holes and blue-stain.]** *Norsk Skogbr.* 6 (8), 1960 (289–90). [Nor.]

In tests in Telemark in 1959, unbarked Pine logs felled in April were (*a*) close-stacked [without stickers] with 30 logs per stack, or (*b*) stacked in a single layer, and were sprayed with a DDT solution, with 3-Frisk T (a commercial emulsion) or with Xylamon G.I. (2% conc.), in April, before the insects had swarmed, or in May, after egg-laying had begun. Damage in untreated logs when inspected in October was 7–12 times that in treated ones; Xylamon G.I. gave the best control (1·3% of the treated surface damaged), followed by 3-Frisk T (4·8%), DDT being less effective (10·3%). For both treated and untreated logs, damage was less for (*a*) than for (*b*). No conclusions could be drawn as to the best time for spraying. Approximate costs for spraying 30 close-stacked logs were: DDT, Kr. 2.50; 3-Frisk T, Kr. 8; Xylamon G.I. 1%, Kr. 9, 2%, Kr. 14.

5069. **The common furniture beetle [*Anobium punctatum*].** *Leafl. For. Prod. Res., Lond.* No. 8 (rev.) 1959. pp. 11. 9 refs.

[Cf. *F.A.* 16 No. 4711.] Slightly expanded to include a section dealing with recognition of *A. punctatum* attack.

5070. WRIGHT, C. G. **A technique useful in comparing powder-post beetle populations in the sub-structures of buildings.** *J. econ. Ent.* 53 (2), 1960 (329–30).

Strips of felt paper 3 × 9 ft. are placed under exposed infested areas, and weekly counts made of the number of piles of powder falling on the paper.

5071. HARRIS, E. C., and TAYLOR, J. M. **Powder-post beetles for test purposes.** *Timb. Technol.* 68 (2251), 1960 (193–5, 197). 10 refs.

Describes in full detail a culturing technique in which beetles are raised on sapwood sticks of Oak (of adequate starch content) in vessels kept at 25° C. and 75% r.h. The technique provides for all stages in the life cycle of *Lyctus brunneus* throughout the year, and tests can thus be conducted independent of normal seasonal limitations. [Cf. *F.A.* 21 No. 3805.]

5072. ***Lyctus* powderpost beetles.** *Leafl. For. Prod. Res., Lond.* No. 3 (rev.) 1959. pp. 10.

Description and life history of *Lyctus* spp. occurring in Great Britain, especially *L. brunneus*, and *L. linearis*; types of damage and timbers affected; losses caused; predators and parasites; control measures (including starch-depletion methods, inspection and hygiene, heat sterilization, chemical treatments). Other powder-post beetles (*Minthea* and *Dinoderus* spp.) are briefly mentioned.

5073. COUDREAU, J. Préservation contre les 'piqûres blanches' des lyctides, des bois tropicaux qui y sont sensibles. **[Preservation of susceptible tropical timbers against attack by Lyctidae.]** *Note tech. Centre Tech. For. Trop.* No. 2, 1958. pp. 38 + 3 + 3 pp. of dgms. [F.]

A general account of *Lyctus* attack is followed by a detailed description of the Australian practice of preservative treatment with H_3BO_3 or Na borate.

5074. KÖRTING, A. Wo steht die Bekämpfung des Hausbockkäfers? **[The present position of *Hylotrupes bajulus* control [in Germany].]** *Holz-Zbl.* 86 (51), 1960 (722). 3 refs. [G.]

Discusses the present infestation rate of roof timbers and the results of treatments, and presents figures collected in Schleswig-Holstein and Bremen to suggest that there has been considerable improvement.

5075. MATHIEU, H. La lutte contre le capricorne des maisons (*Hylotrupes bajulus*) par le traitement des bois à l'air chaud. **[The hot-air treatment of wood for the control of *H. bajulus*.]** *Bois et Scieries* 66 (16), 1960 (341 . . . 349). 8 refs. [F.]

Briefly describes the biology, life cycle, and habitat of, and damage caused by, *H. bajulus* in France, and gives details of a method of sonic detection using a "Bajuphon" detector, and a control method using a hot-air pressure treatment developed over 30 years ago in Denmark. Some graphed and tabulated data are given on temperature requirements for given wood thicknesses, duration of treatment, etc.

845.3. Termites

See also Nos. 4930, 5023–4.

5076. COUDREAU, J., *et al.* Recherches en vue de déterminer une nouvelle méthode destinée à apprécier la resistance d'un bois aux destructions causées par les termites (*Reticulitermes lucifugus* Rossi). **[Research to develop a new method of appraising the resistance of wood to attack by *R. lucifugus*.]** *Holzforschung, Berlin* 14 (2), 1960 (40–51). 5 refs. [F.f.e.g.] P.R.

In work at the Centre Technique Forestier Tropical to develop a quick laboratory technique of testing termite resistance, the criterion used to appraise attack was weight loss of the wood. Details of the work are given, and also the results of tests on several tropical and temperate woods.

5077. SCHMIDT, H. Ein Termiten-Test an Sägespänen verschiedener Holzarten. **[A termite test with sawdust of different wood species.]** *Holz*

Roh- u. Werkstoff 18 (2), 1960 (59–63). 7 refs. [G.g.e.] P.R.

[Cf. *F.A.* 16 No. 2396; 18 No. 1077.] Investigations were made on sawdust of 93 temperate and tropical species of economic importance (listed), 10 of them conifers, in order to select those with a toxic or deterrent effect on termites (*Reticulitermes flavipes*). The woods were grouped according as the termites died (1) in 1–2 days, (2) after 2–6 days, (3*a*) in 1–3 weeks, (3*b*) in 3–4 weeks, (3*c*) in 4–6 weeks, (3*d*) in 6–10 weeks, or (4) the wood was used by the termites without apparent harm, or (5) the wood did not harm the termites and $> \frac{2}{3}$ of them were alive and healthy after 10 weeks. The only woods in group (1) were *Pinus caribaea*, *Guarea cedrata*, *Staudtia gabonensis* and *Mansonia altissima*.

5078. Gösswald, K. Zum Wirkungsmechanismus von Thiodan. **[The mode of action of Thiodan.]** *Zeitschrift für angewandte Zoologie, Berlin* 45 (2), 1958 (129–51). 13 refs. [G.] L.S.

Describes chiefly experiments with *Kalotermes flavicollis*. The poison (a heterocyclic hydrocarbon containing S) greatly increased O consumption, the effect being intensified by warmth and humidity. Experiments with the ant *Lasius niger* showed that it acted chiefly as a contact poison. Ants feeding direct on poisoned food died, but those fed indirectly with regurgitated material recovered. Used as a soil poison, Thiodan at 0·05% concentration and as little as 0·25 c.c. to 5 g. of sand, killed all *K. flavicollis* in 5–6 days. After artificial weathering (treatment at 60° C. and 40 or 95% r.h.), the compound was slightly less effective but still adequate.

846. Steaming

See Nos. 5083–4.

847. Drying (Seasoning)

See also Nos. 4838, 4890, 4952, 4967, 5096–8.

5079. **Moisture content of wood in relation to air humidity.** *Technical Note, Forest Products Research Institute, Laguna, Philippines* No. 1, 1959. pp. 4. P.R.

A brief and very general outline of the seasoning requirements of various Philippine timbers [unspecified] for local use in furniture making and construction, with suggestions for meeting the stricter seasoning conditions required when exporting to N. America.

5080. Huffman, J. B. **Forced-air drying of Gum and Oak crossties.** *Sth. Lumberm.* 200 (2500), 1960 (33 . . . 37). 3 refs.

In an exploratory study in N. Carolina, started in March 1959, sleepers of Black and Red Gum [*Nyssa sylvatica* and *Liquidambar styraciflua*] and of Red and White Oaks, stacked in the open, were dried to 55% m.c. in 54 and 122 days respectively, using four automatically controlled 18-in. fans, powered by two $\frac{1}{3}$-h.p. motors, to draw air through the stacks at 375 ft./min. whenever r.h. was $< 80\%$ (ca. 8 hr./day). Tabulated data of drying and subsequent pressure-creosoting characteristics indicate that these sleepers were about equal, in m.c., water loss, general condition, and creosote retention and penetration, to sleepers air-dried ca. 3 times as long. Operating costs and capital requirements were low. [Cf. *F.A.* 20 No. 1183.]

5081. Englerth, G. H. **Air drying conditions for lumber in the San Juan area, Puerto Rico.** *Trop. For. Note Trop. For. Res. Cent., Rio Piedras* No. [1], 1960. pp. 2.

Briefly outlines the importance of stacking, particularly emphasizing the optimum use of stickers, in seasoning timber, and gives details of a drying schedule for hardwoods based on a record of drying *Carapa guianensis* in the San Juan area from Oct. to Dec. 1956.

5082. Bryce, J. M., and Kitambi, G. A. **The air-drying properties of some Tanganyika timbers.** *Tech. Note Util. Div. For. Dep. Tanganyika* No. 23, 1960. pp. 5 + 2 tbls.

Describes the results of air-drying experiments made at Moshi, Tanganyika, on: *Brachystegia microphylla*, *B. spiciformis*, *Casearia battiscombei*, *Cassipourea malosana*, *Cephalosphaera usambarensis*, *Cupressus lusitanica*, *Diospyros abyssinica*, *Ficalhoa laurifolia*, *Julbernardia globiflora*, *Macaranga conglomerata*, *Olea welwitschii*, *Parinari goetzeniana*, *Pinus patula*, *P. radiata*, and *Podocarpus gracilior*.

5083. Gonet, B., Krzysik, F., and Szmit, J. Wstępne badania wpływu parowania na przebieg wysychania i nasycania bukowych podkładów kolejowych. **[Preliminary investigations on the effect of steaming on the subsequent drying and impregnation of Beech sleepers.]** *Sylwan* 104 (2), 1960 (1–16). 13 refs. [Pol.russ.e.]

Sleepers made from timber felled in winter were steamed (127° C., 1·5 atm.) for 6 hours in April, and then stacked for air seasoning until Sept. 17, when they were impregnated with creosote. Steamed and unsteamed sleepers dried out similarly and absorbed the same amount of preservative, but it is thought that, when the optimum steaming schedule is found, steaming will show advantages. The course of moisture changes in the sleepers during seasoning is discussed.

5084. Campbell, G. S. **Presteaming cuts drying time of "Ash" Eucalypts.** *For. Prod. Newslett. C.S.I.R.O. Aust.* No. 263, 1960 (1–3).

Gives details of pre-steaming tests made on *Eucalyptus gigantea* and *E. regnans* in Victoria and Tasmania as part of a programme started in 1957 to examine certain aspects of collapse in drying, with suggestions for the commercial application of the method. Good results are also reported for *Nothofagus cunninghamii* in Tasmania and *Shorea* spp. in Victoria.

5085. Kollman, F., and Schneider, A. Der Einfluss der Belüftungsgeschwindigkeit auf die Trocknung von Schnittholz mit Heissluft-Dampf-Gemischen. **[The influence of the air velocity on the drying of sawn timber in mixtures of hot air and steam.]** *Holz Roh- u. Werkstoff* 18 (3), 1960 (81–94). 19 refs. [G.g.e.] P.R.

The second report of a series [see *F.A.* 20 No.

3874]. The theory involved in drying by this method is discussed in detail, and actual tests were made on single boards of Pine sapwood and Beech at 65° C., 70% r.h., and at air velocities of 1–13·5 m./sec. The influence of air velocity upon the rate of drying was greatest during the initial drying period, and thereafter gradually decreased and finally disappeared. During the initial period of drying, the drying rate increased with the air velocity as follows: in the range 3–5 m./sec. with the 0·5th power of Reynold's number; at 5–7 m./sec.—0·53; at 7–9 m./sec.—0·575; and at 9–13·5 m./sec. —0·60. The influence of air velocity in standard stack drying will not differ markedly from these results obtained for single boards. Investigations showed that a considerable amount of power could be saved by drying with extremely high flow velocities (12 m./sec.) in the initial period of drying.

5086. ANDERSON, A. B., and FEARING, W. B. **Solvent seasoning of Tanoak.** *For. Prod. J.* 10 (5), 1960 (234–8). 14 refs.

In laboratory tests, 4/4 [1-inch] boards of *Lithocarpus densiflorus* sapwood were dried from green to 10% m.c. in < 30 hours when the boards were placed in an upright position in a stainless-steel treating unit and the solvent (acetone heated to 130° C.) was circulated and sprayed on to the boards from above. Boards immersed upright in the solvent took ca. twice as long to dry, and in a horizontal position much longer, suggesting that the solvent flowing over the boards entered the vessels and cell openings and moved inside the boards by gravity. Lower solvent temperatures also prolonged drying time. No significant moisture gradient was found through the thickness of the boards, and they were free of stresses and relatively free of other defects. [Cf. *F.A.* 20 No. 5301.]

5087. STEVENS, W. C. **Twist in Sitka Spruce.** *Timb. Tr. J.* 232 (4353), 1960 (83–5).

Sitka Spruce grown in the U.K. has a tendency to twist in seasoning, always in one direction. Intensity of twist depends both on final m.c. and on position of the piece in the tree, but does not appear to be much influenced by locality. A method of counteracting it was to introduce mechanically an opposite twist during seasoning and to hold it for a period long enough to ensure that the dried material, when released from restraint, would retain a degree of "permanent set" sufficient to nullify the inherent opposite tendency. Results of successful experiments on a parcel of 4 × 2- and 5 × 2-in. Sitka are detailed and discussed.

5088. FEFILOV, V. V., and SOKOLOVA, A. I. Suška melkoj drevesiny v kipjaščem sloe. **[Drying comminuted wood in a 'boiling layer'.]** *Gidrol. lesohim. Prom.* 11 (7), 1958 (15–7). [Russ.russ.] P.R.

Describes a kiln for drying sawdust, and experiments on sawdust of Birch, Aspen, Pine and Spruce. The heating agent is air at 170–220° C., 'boiling off' the moisture at rates up to 200 kg./hr. per cu. m. of sawdust. The kiln had an output of 300–400 kg. sawdust/hr. (oven-dry weight).

848. Timberyard Practice. Handling and Storage of Timber

See also Nos. 4433, 4990–1, 5115.

5089. DONČEV, G. Ustrojstvo na skladovete za bukovi trupi v dărvoreznite predprijatija. **[Layout of storage yards for Beech logs in Bulgarian sawmills.]** *Nauč. Trud. Lesoteh. Inst., Sofija* No. 7, 1959 (239–61). 19 refs. [Bulg.g.]

Examines the lay-out, organization and mechanization in the storage yards of 14 mills handling Beech logs, and presents two ground plans of rationally planned, fully mechanized yards.

5090. WRIGHT, E., KNAUSS, A. C., and LINDGREN, R. M. **Sprinkling to prevent decay in decked Western Hemlock logs.** *Res. Note Pacif. Nthwest. For. Range Exp. Sta.* No. 177, 1959. pp. 10. 2 refs.

Results of a study on stacked *Tsuga heterophylla* logs at Salem, Oregon, to determine how much decay and pulp yield loss would occur during 1 and 2 years of storage, and whether decay could be reduced by continuous sprinkling with water during the dry summer months. The volume of decay in 160 logs (80 green and 80 old, with some decay) was measured before storing them in (*a*) water-sprinkled and (*b*) unsprinkled decks. When measured again after 1 year, not enough decay had developed in either deck to reduce pulp yield; but after 2 years, a significant amount of decay had developed in (*b*) and pulp yield was reduced by 4% for fresh logs and 13% for old logs. Fresh logs in (*a*) remained undamaged, while old logs showed a pulp loss of 3%. Temperature measurements during storage showed that sprinkling did not cool logs sufficiently to inhibit decay. The higher moisture content of logs in (*a*), 82·1–149·0% vs. 41·3–92·4% for logs in (*b*), is believed to be responsible for inhibiting decay The fungi most commonly found causing decay were identified.

5091. **Unique bundling system.** *Pulp & Paper, Bristol, Conn.* 32 (2), 1958 (126–8). L.S.

Describes an installation in which the wood, which arrives in steel-strapped bundles of 5000–6000 bd. ft. (3–100 logs) after rafting, is driven, still bundled, to a log well by an artificial current. From there, an overhead travelling crane lifts it with slings and deposits the logs, after the straps have been removed in the air, on to a transfer chain for delivery singly to the mill. Formerly the bundles were unstrapped in the pond and manoeuvred singly to the log haul.

5092. SOINÉ, H. Das Förderwesen in der Holzindustrie—Vierte Mitteilung: Krananlagen—Hängebahnen, Hängekräne. Fünfte Mitteilung: Krananlagen. **[Transport systems in the woodworking industry. IV. Crane systems—overhead conveyors and travelling cranes. V: Crane installations.]** *Holz Roh- u. Werkstoff* 18 (3; 4), 1960 (111–5; 125–31). 2 refs. [G.g.e.] P.R. [Cf. *F.A.* 21 No. 3824.]

85. Grading of Wood and Wood Products

851. Timber Quality in General

See Nos. 4939 *et seq.*, 4992–4, 4998–9.

852. Detection, Recognition and Assessment of Injuries and Defects

See also Nos. 4398–9, 4714, 4873–4, 4946, 4955–6, 4963, 4972–3, 4997, 5002, 5087.

5093. BRYAN, W. C. **Losses from defect in Piedmont hardwoods**. *Sta. Pap. Stheast. For. Exp. Sta.* No. 109, 1960. pp. 31. 24 refs.

[See *F.A.* 19 No. 4964.] A fuller, illustrated account of the study, supplemented by a mill study based on 130 butt logs of Red and White Oaks, *Liquidambar styraciflua*, *Liriodendron tulipifera* and Hickories, relating external indicators to wood defects.

5094. HIRAI, S. **[Wood quality.]** *Repr.* from *A report of the scientific investigations of the forests wind-damaged in 1954*. Hokkaido. [*n.d.*] pp. 299–330. [Jap.jap.e.*e.*]

Wood quality of trees damaged by wind in 1954 [cf. *F.A.* 16 No. 4167] was studied in 1955–56. Results include the following: (1) In 8 trees of *Abies sachalinensis* (d.b.h. 32–46 cm., either windthrown or broken), sawing showed that compression failure generally appeared on the lee side of the bole, with splits across the grain on the tension or windward side. Such damage probably exists in all broken and uprooted trees and may be expected in apparently undamaged standing trees. It was found up to 9 m. above the point of breakage. (2) In wood density measurements on 24 damaged trees of *Picea jezoensis*, 4 of *P. glehnii* and 11 of *A. sachalinensis*, oven-dry density of sapwood in uprooted trees and in standing and broken parts of wind-broken trees was some 10% lower than that of undamaged standing trees. Similar reductions in density were found in logs stored in the timberyard and in water. Results are compared with those of similar measurements on wind-damaged trees in 1936. (3) Examinations for defects in 1936 and 1954 showed uneven ring-width, compression wood and frost-shake, which may have resulted from the changed conditions brought about by wind damage. (4) Measurements on *A. sachalinensis* showed little difference in the length of splits in the bark and in the wood, but in *P. jezoensis* the actual split proved to be considerably longer than that visible through the bark, the maximum difference being 3 m. Studies on *Fagus crenata* at timberyards and mills showed that quality can be judged satisfactorily from superficial inspection.

5095. IJJÁSZ, E. Ranura y cuenca de pino radiata. **[“*Ranura*” and “*cuenca*” in *Pinus radiata*.]** *Carib. For.* 20 (1/2), 1959 (52–7). [Span.span.]

Describes two types of anomalous wood formation, possibly typical of *Pinus radiata* in Chile, since they have not been reported elsewhere. (1) ‘*Ranuras*.’ These are localized grooves or surface depressions on the stem, formed round the base of the needle bundles. They are usually 5–40 mm. long, 1–8 mm. wide and 5–20 mm. deep, and sometimes occur within a linear depression running the length of the stem; variations in size and distribution may occur within the same tree. They occur only on trees of great vigour. The author believes that they may in fact result from this vitality, the diameter increasing very rapidly and growing round the base of the needle bundles before they are shed. ‘*Ranuras*’ arise only while the stem bears needles, and they are covered by subsequent growth. In the wood itself they cause undulations in the growth ring, producing a wavy grain and giving rise to the type of wood known as resonance wood in Spruce in Europe. This is not necessarily a defect, and may in fact enhance the value of the wood. (2) ‘*Cuencas*.’ These are bowl-shaped depressions in the stem, caused by pressure at the base of cones that persist too long. Like ‘*ranuras*’, they occur only in trees of great vigour, arising in a similar fashion when diameter growth is rapid. The unshed cone peduncles eventually give rise to a defect similar to encased knots, and such cones should therefore be eliminated by judicious pruning.

5096. KNAUSS, A. C., and CLARKE, E. H. **Seasoning and surfacing degrade in kiln-dried Douglas-Fir in western Oregon**. *Res. Note Pacif. Nthwest. For. Range Exp. Sta.* No. 173, 1959. pp. 13.

Presents the results of a detailed study at a sawmill at Dallas, using ca. 75,000 bd. ft. of lumber. The amount of degrade, based on the difference between the green volume and potential grade and the dry-surfaced volume and grade, was determined and its causes were analysed. Manufacturing degrade was distinguished from seasoning and surfacing degrade, and the loss in value for each grade was calculated.

5097. KAUMAN, W. G. **Contribution to the theory of cell collapse in wood: Investigations with *Eucalyptus regnans***. *Aust. J. appl. Sci.* 11 (1), 1960 (122–45). 20 refs. P.R.

To test the theory that total collapse is the sum of liquid tension collapse and stress collapse, ⅞-in. cubes of *E. regnans* were dried at temperatures ranging from 70° to 285° F., using two levels of humidity at each temperature. In addition, ⅞ × ⅞ × 3-in. specimens were dried at 150° at low humidity. The results showed good agreement with theoretical values for wood temperatures up to ca. 190°; for higher temperatures or very low humidities, collapse was found to be significantly time-dependent. Collapse in small end-sealed cubes was of the same order as that in the thickness of boards of rectangular cross-section, but the latter collapsed less in width. *From author’s summary.*

5098. ANDERSON, A. B., *et al.* **Influence of extractives on seasoning stain of Redwood lumber**. *For. Prod. J.* 10 (4), 1960 (212–8). 6 refs.

A study on the behaviour of extractives under various kiln and air-drying schedules indicated that they tended to move towards the surface under all drying conditions, and that lateral movement was causing sticker stain [cf. *F.A.* 20 No. 5312]. The degree of migration increased with the moisture content of the green material. Higher humidities, by converting some of the water-soluble extractives into alcohol-soluble, tinctorial material produced darker boards. The lighter coloured boards, by reason of having more labile, water-soluble substances near the surface, were more liable to darken and stain on exposure. Pre-steaming reduced the content of both water- and alcohol-solubles in the surface layers as compared with that in unsteamed, seasoned wood, and also reduced surface moisture absorption. Studies on extractives placed in the kiln under various experimental conditions suggested that the staining component consists largely of tannin and other polyphenolic substances, which are highly sensitive to oxidation, temperature, and high humidity.

853. Grading of Wood in the Rough

See also Nos. 4439, 4724, 4988, 4992–3.

5099. OSTRANDER, M. D. **New hardwood log grades for shoelast and bowling-pin blanks.** *For. Prod. J.* 10 (5), 1960 (238–42). 5 refs.

Describes a modified grading system developed for the industry, whose chief requirement is short lengths of clear sapwood. The wood used is Sugar Maple.

5100. SNELLMAN, G. O. Några reflektioner om äldre och nyare tiders begrepp beträffande sortering av sågade trävaror. **[Reflections on past and present concepts in timber grading.]** *Pap. ja Puu* 42 (5), 1960 (327–42). [Sw.fi.e.] P.R.

Presents notes on grading hewn and sawn timber in Scandinavia and Finland since about 1500 A.D. and stresses the differences in requirements between today's grades and those with the same names in the past.

854. Grading of Converted Timber

See also Nos. 4819, 4838, 4988, 4992–3, 4997, 5002, 5007–9, 5100.

5101. Especificaciones técnicas para el suministro de traviesas de ancho normal de roble, haya o pino. **[Technical specifications for the supply of sleepers of normal width of Oak, Beech or Pine.]** *Hoja divulg. Serv. Madera, Madrid* No. 15, 1960. pp. [2]. [Span.]

Relates mainly to the acceptable characteristics and properties of the wood, methods of stacking, and dimensions.

5102. **Milled products from south-eastern Australian hardwoods.** *Aust. Stand.* Nos. 0.62–0.65, 1958. pp. 22. Price 7*s.* 6*d.* P.R.

Gives the following specifications: No. 0.62—Flooring, No. 0.63—Lining, No. 0.64—Weatherboards, No. 0.65—Mouldings, all milled from south-eastern Australian hardwoods.

5103. **Interim grading rules for sawn Radiata Pine for use as building scantling.** *Inter. Specif. Stand. Ass. Aust.* No. *SAA Int.* 376, 1958. pp. 7. P.R.

861. Pulp and Paper Manufacture. Textile and other Cellulose Derivatives

See also Nos. 4124, 4827–30, 4865–6, 4892–3, 4908, 4910, 4912, 4941, 4995–6, 5125, 5230, 5235.

5104. LINDBERG, N. J. Gammalt och nytt i Japans pappersindustri. **[Old and new in Japan's paper industry.]** *Pap. ja Puu* 42 (4*a*), 1960 (269–76). [Sw.e.] P.R.

Discusses the history of papermaking in Japan, describes the present-day hand-made paper industry (using chiefly Kodzu [*Broussonetia papyrifera*] bark as raw material), and gives some figures for production and export of machine-made paper (using home-grown and imported pulpwood).

5105. NIESCHLAG, H. J., *et al.* **A search for new fibre crops.** *Tappi* 43 (3), 1960 (193–201). 33 refs. P.R.

Describes preliminary work on fibre-producing plants in which an evaluation procedure involving consideration of botanical characteristics, chemical composition, dimensions and yield of fibrous constituents, and a qualitative physical and visual appraisal of the plants, has been devised. Data including density measurements on 58 plant species representing 11 families, are reported, representatives of the Gramineae, Leguminosae, and Malvaceae being the most promising among the limited number of samples examined.

5106. BHAT, R. V., GUHA, S. R. D., and VIRMANI, K. C. **Newsprint grade groundwood pulp from *Abies pindrow* Royle (Silver Fir).** *Indian For.* 86 (5), 1960 (302–5). 3 refs.

Laboratory experiments are described. Standard pulps were made from 100% groundwood pulp of this species and from a mixture of 70% groundwood pulp with 30% bleached Bamboo chemical pulp. It is concluded that *A. pindrow* groundwood pulp is a suitable raw material for the production of newsprint. *From authors' summary.*

5107. SKALICKY, C., and VONDRÁKOVÁ, M. **Effect of manufacturing conditions on properties of chemigroundwood from some hardwoods.** *Sborník Výzkumnych Prací z Oboru Celulosy a Papíru* 3, 1958 (7–35). [Cz.?] From *abstr.* in *Chem. Abstr.* 54 (9), 1960 (9281). P.R.

Describes experiments on the pilot-plant production of chemigroundwood in which Beech, Poplar and Birch logs were impregnated at 40–50° C. with a 6/1 solution of Na_2SO_3 and $NaHCO_3$ before steam treatment at 120–155° for 4–7 hours. Pulp brightness was greater and strength properties less after steaming at $< 145°$ than at 145–155°, but the roles of the other variables, e.g. time, chemical concentration, impregnation method and grinding conditions, were relatively unimportant. The results also show that pulp strength decreases as log diameter increases. For Birch and Beech this decrease is linear, practically eliminating their use at > 150 mm. diam. For Poplar this relationship is non-linear, indicating the comparative ease of impregnating low-diameter logs. The authors claim that a cheaper chemigroundwood pulp is obtainable by impregnating and steaming than by cooking.

5108. Wu, C., and Lauer, K. **Sawdust pulping.** *Journal of the Alabama Academy of Science, Birmingham* 31, 1959 (139–43). From *abstr.* in *Chem. Abstr.* 54 (9), 1960 (9284). P.R.

Gives details of the shorter cooking periods required for sawdust than for chips because of the easier access of the cooking liquor to the primary wall, and also of the inferiority of sawdust kraft pulps because the individual wood fibres are cut and damaged by the saw.

5109. Wither, R. P., and Captein, H. A. **Laboratory evaluation of nitric acid pulping of bagasse and softwoods.** *For. Prod. J.* 10 (3), 1960 (174–7). 12 refs.

Reports on tests with bagasse, Pacific Coast Cedar and Hemlock chips and shavings using dilute HNO_3, NO_2, and solvents containing HNO_3, mostly following known processes. It is concluded that, at the present stage, because of costs and other drawbacks the process is not a promising one for small-scale pulping. [Cf. *F.A.* 16 No. 4759.]

5110. Phillips, F. H., and Watson, A. J. **Pulping studies on New Guinea woods. I. Sulphate, sulphite, and neutral sulphite semi-chemical pulps from *Excoecaria agallocha* L. and *Camptostemon schulzii* Mast.** *Div. For. Prod. technol. Pap. For. Prod. Aust.* No. 8, 1959. pp. 19 + 1 plate. 9 refs.

[Cf. *F.A.* 21 No. 1164.] The chemical and pulping properties of *E. agallocha* and *C. schulzii* were investigated. Sulphate pulp that compared favourably with a commercial Eucalypt sulphate pulp in bursting and tensile strengths was readily produced, but tearing resistance was lower. Satisfactory sulphite pulps were obtainable with normal cooking procedures, while high yields (60%) of readily defibred pulps were obtained with bisulphite cooking liquor containing only 1·25% total and 0·5% combined SO_2. High yields (71–77%) of good-strength, light-coloured neutral sulphite semi-chemical pulp were obtained with a wide range of cooking liquor concentrations. Pulps obtained from *E. agallocha* by the methods investigated were consistently of better quality than those of *C. schulzii*, but all processes gave satisfactory pulps from a 50/50 mixture of the two species. *From authors' summary.*

5111. Runkel, R. O. H., and Schambach, H. Über den Einfluss der Temperatur bei der Herstellung von Halbzellstoffen aus Laubhölzern im alkalischen Verfahren. Zweite Mitteilung. **[Effect of temperature on the manufacture of semichemical pulp from broadleaved species by the alkaline process. Second communication.]** *Holzforschung, Berlin* 14 (2), 1960 (33–40). 31 refs. [G.g.e.] P.R.

[Cf. *F.A.* 15 No. 920.] Investigations were made on the CCS (cold NaOH) process and on the mild (from 40 to $\ngtr$ 100° C.) NaOH process with Beech. Paper chromatographic analysis of the pulps revealed xylan, and xylose, arabinose, galactose, mannose, glucose, ribose and rhamnose.

5112. Legg, G. W., and Hart, J. S. **Alkaline pulping of Jackpine and Douglas Fir. The influence of sulphide and effective alkali charge on pulping rate and pulp properties.** *Pulp Paper Mag. Can.* 61 (5), 1960 (299–304). 8 refs.

Confirms earlier work [cf. *F.A.* 18 No. 3490] which showed that an increase in sulphide and effective alkali charge increases the rate of pulping to a maximum. It was established that the maximum rate of pulping is the same for hardwoods and softwoods when they are cooked under optimum pulping conditions, and also that, during kraft cooking, certain wood constituents are removed in proportions similar to the amounts present in the original woods, regardless of wood species.

5113. Legg, G. W., and Hart, J. S. **Alkaline pulping of Poplar and Birch. The influence of sulfidity and effective alkali on the rate of pulping and pulp properties.** *Tappi* 43 (5), 1960 (471–84). 24 refs. P.R.

Studies the influence of various cooking variables, as found in mill practice, on the kraft pulping of *Populus tremuloides* and *Betula papyrifera*, and confirms the findings of previous work on *Thuja plicata* [*C. A. Christiansen, et al.*, in *Tappi* 40 (5), 1957], that the pulping rate increases with increasing sulphide and effective alkali charge. It was found that variations within a species account for greater differences in pulp quality and pulping properties than any other variable studied.

5114. Reis, C. J., and Libby, C. E. **An experimental study of the effect of *Fomes pini* (Thore) Lloyd on the pulping qualities of Pond Pine, *Pinus serotina* (Michx.) cooked by the sulfate process.** *Tappi* 43 (5), 1960 (489–99). 34 refs. P.R.

Mixtures of *P. serotina* in (*a*) sound condition, and at (*b*) incipient, and (*c*) advanced, stages of *F. pini* decay were pulped by the sulphate process. From the results obtained, the following main conclusions were drawn: (1) Pulp yield decreases progressively from (*a*) to (*c*); (2) tearing strength decreases, and breaking length and bursting strength of the pulp increase from (*a*) to (*c*), though its folding endurance, apparent density, and brightness are not significantly affected by fungal activity in the wood; (3) the lignin content of the pulp decreases from (*a*) to (*c*), though only a slight decrease in cellulose content occurs for (*c*); (4) a greater α-cellulose content of the pulp was observed for (*c*) than for (*a*) and (*b*); (5) the degree of polymerization of the cellulose pulp remains almost constant, until the onset of (*c*), when a considerable decrease occurs; (6) the cellulose content of the wood remains about constant, up to stage (*c*), when it decreases considerably; (7) the lignin and pentosan contents of the wood decrease rapidly from (*a*) to (*c*); (8) a decrease in the sp. gr. of the wood does not occur before stage (*c*).

5115. Russell, P. **The inactivation of organomercurial fungicides by sulphur compounds in groundwood made from salt-water stored pulpwood [with an appendix: Chemical investigations on the sulphur compounds in certain seawater stored logs, by *R. J. Peerless*].** *Norsk Skogind.* 14 (4), 1960 (126–35). 11 refs. [E.nor.] P.R.

A fuller account, with numerical data, of studies already briefly described [see *F.A.* 20 No. 5329].

5116. Morak, A. J., and Ward, K., Jr. **Investigations of the mannans and xylans in softwood.** *Tappi* 43 (5), 1960 (413–20). 16 refs. P.R.

Compares the efficiency of 4 alkaline-extraction sequences viz. (1) NaOH followed by KOH, (2) KOH followed by NaOH, (3) KOH followed by K borate, and (4) K borate alone [cf. *F.A.* 20 No. 5336], in removing (*a*) mannose and (*b*) xylose from Spruce wood and pulp. Under the conditions adopted, the most satisfactory results were obtained with (1) for (*a*) and with (2) for (*b*); (4) efficiently removed (*b*), whereas (3) removed only ca. 50% of (*a*). An examination of the hemicellulose recovery showed interesting fractionation effects, which are discussed, and also the formation of a hemicellulose material soluble in 70% ethanol.

862. Composite Materials made Wholly or Partly of Woody Matter

See also Nos. 4829, 4838, 4882, 4959, 5001, 5047.

5117. **Board materials: types, properties, uses.** *Wood* 25 (4), 1960 (133–73).

Includes articles on: Patterned boards for ceilings; Early [pre-1939] examples of fibreboard usage (*J. G. Davies*); Building regulations and the use of fibreboard; Hardboard-faced flush doors [describing a plant]; Fibre building board and broiler houses (*D. W. B. Sainsbury*); Categories of fibre building boards [a classified reference to sizes and properties of brands within the FIDOR membership]; Particle board for flush doors (*J. Pound*); Particle board for furniture and building components (*L. E. Akers*); New board materials and equipment.

5118. Nykänen, P. Lastulevyprosessi ja sen valvonta. **[The particle-board manufacturing process and its control.]** *Pap. ja Puu* 42 (4*a*), 1960 (219 . . . 233). [Fi.fi.e.] P.R.

The need for statistical quality control and the methods used are discussed. Variables involved include chip thickness and moisture content, resin content, chip feed, mat weight, and also board dimensions and physical and mechanical properties. [Cf. *F.A.* 21 No. 3846.] *From author's summary.*

5119. Liiri, O. Tutkimuksia lastutuksesta sekä lastun ominaisuuksien merkityksestä lastulevyn valmistuksessa I–III. **[Investigations on particle properties in the manufacture of particle board I–III.]** *Pap. ja Puu* 42 (2; 3; 4*a*), 1960 (57–62; 105–9; 197 . . . 212). 15 refs. [Fi.e.*e*.] P.R.

Results of tests at a particle-board factory and in the laboratory, on preparing particles from raw material and on the properties of boards, are presented in tables and graphs. Machines used are illustrated. Raw materials for the outer-layer particles were veneer-log cores and round wood and, for the middle-layer particles, chips prepared in chippers from small wood (thinnings, logging waste, etc.). Board properties studied were modulus of rupture [*f*], tensile strength, water absorption and dimensional stability. The following are the main conclusions: (1) In particle preparation, dulling of the knives causes an abrupt decrease in particle length and width and in machine capacity, and increases in variation of particle thickness, amount of fines, and power consumption: knife maintenance is therefore very important. Wood moisture content is an important factor in knife dulling. (2) Small timber, brought from the forest either as round wood or chips, is a satisfactory raw material in certain conditions. (3) Chips proved best as raw material for the middle-layer particles, those prepared in a disk-type chipper being more suitable than those from a cylinder-type chipper. (4) A decrease in particle length and width resulted in decreased *f* and increased swelling of the board. (5) In the test conditions, a decrease in thickness of the outer-layer particles from 0·3 to 0·1 mm. resulted in an increase in *f* and in swelling. (6) An increase in *f* caused by changes in particle length and width, or in resin content, was associated with decreased amounts of swelling, but when the increase in *f* was caused by increase in sp.gr., the swelling also increased. (7) Increased resin content improved all board properties. (8) Increased m.c. in the outer layer, brought about by spraying, increased the tensile strength ⊥ to the plane of the board and the surface smoothness, and sometimes reduced swelling, but caused a decrease in *f* and an increase in splitting of the outer-layer particles in machining. (9) An increase in the thickness of the outer layer improved board properties; sanding caused a slight increase in *f*. *From author's summary.*

5120. Darda, A. F. Fiziko-mehaničeskie svojstva drevesno-stružečnyh plit. **[Physical and mechanical properties of particle boards.]** *Derev. Prom.* 9 (1), 1960 (8–10). [Russ.] P.R.

From the results of tests in 1959, compares the properties of Bartrev boards, two other chipboards, a veneered chipboard, and a coreboard, all produced by Soviet factories. The tests were aimed at fixing standards for boards to be used in furniture production. It is concluded that plain chipboards should have the following properties: density, 0·65 ± 0·1 g./c.c.; static bending strength, ≮ 100 kg./sq. cm.; shear strength, ≮ 8 kg./sq. cm.; modulus of elasticity, ≮ 12,000 kg./sq. cm.; screw-holding capacity—face ≮ 6, edge ≮ 4 kg./sq. mm.; swelling (in thickness) after 24 hr. in water, ≯ 30%; swelling (in thickness) after 28 days in air at 100% r.h. and 20° C., ≯ 8%.

5121. Bryan, E. L. **Bending strength of particle board under long-term load.** *For. Prod. J.* 10 (4), 1960 (200–4). 7 refs.

Though test results with Douglas Fir flakeboards at stresses corresponding to 65 to 85% of the mean modulus of rupture showed a wide scatter, because of considerable variability in static bending strength, there appeared to be an exponential relationship in the 65–80% range between the stress ratio and time to failure. Neither binder (urea or phenolic) nor sp.gr. (0·65 and 0·8) appeared significant. Deflection patterns were similar to those found in wood.

5122. Brumbaugh, J. **Effect of flake dimensions on properties of particle boards.** *For. Prod. J.* 10 (5), 1960 (243–6). 3 refs.

A study of interactions of (*a*) 4 flake lengths (½ to 4 in.), (*b*) 4 flake thicknesses (0·009 to 0·018 in.), (*c*) 3 degrees of board specific gravities (0·65 to 0·85) and (*d*) 2 adhesive contents (3 and 5%) in Douglas Fir boards. For all values of (*c*) and (*d*) bending strength increased with increasing (*a*), (*b*) having no influence. Internal bond strength was greater for short, thick flakes. Dimensional stability increased with increasing (*a*) and decreasing (*b*). For optimum properties in general, the length/thickness ratio should be $\nless$ 200.

5123. ENGELS, K. Besprüh-Beleimung. **[Gluing by spraying.]** *Holz Roh- u. Werkstoff* 18 (4), 1960 (131–40). [G.g.e.] P.R.

Discusses principles, and the spray patterns from various spray systems, in the context of chipboard manufacture.

5124. HALL, R. B., LEONARD, J. H., and NICHOLLS, G. A. **Bonding particle boards with bark extracts**. *For. Prod. J.* 10 (5), 1960 (263–73). 24 refs.

Reviews previous research on the use of powdered bark or bark extract as the major component of a bonding agent for hot-pressed boards, and describes experiments indicating that it is technically possible to use an extract of *Pinus radiata* bark for the production of boards comparable to boards bonded with urea-formaldehyde resins. Best extraction yields were obtained with aqueous Na_2CO_3 at high temperatures, and addition of sulphite improved the stability of the extract. The most satisfactory hardener was *p*-formaldehyde. Dry defibrated pulp from sawdust, selected sawdust, and dry defibrated planer shavings of *P. radiata* were used.

5125. VINOGRADOV, JU. N., DENISOV, O. B., and TRAJTEL′MAN, G. JA. Pressovanie drevesno-stružečnyh plit s bardjanym koncentratom. **[Pressing chipboard made with a sulphite-alcohol liquid residue [as a binder].]** *Derev. Prom.* 9 (3) 1960 (11–2). [Russ.] P.R.

Describes a method of increasing the water resistance (w.r.) of chipboard made on an experimental scale using as a binder, in place of resins, a residual liquid concentrate obtained from the distillation of sulphite-alcohol products. The use, with this binder, of a normal chipboard pressing schedule, viz. pressing temperatures of 120–140° C. and a duration of 1 min. per 1 mm. board thickness, resulted in very poor w.r. At 200–240°, however, w.r. increased considerably and when the pressing time was increased to 2 min./1 mm. thickness, a further considerable decrease in water absorption was obtained (data tabulated). Static bending strength, fairly constant at 140–200°, decreased sharply at > 200°. Optimum pressing temperature for 10-mm.-thick boards (wt./vol. 0·6–0·8 g./c.c.) was 220–230°. W.r. was also affected by % binder used; boards containing 10%, pressed for 10 min. at 140 and 240°, showed a water absorption of 14·2 and 12·5% respectively after 20 days, vs. 9·9% for boards containing 20% binder pressed for 30 min. at 240°. It is concluded that full-scale production of chipboard by the method described is practicable, and cheaper than that obtained by using standard resin binders.

5126. ČEREZOVA, V. M. Uskorennoe pressovanie drevesno-stružečnyh plit. **[Accelerated pressing of particle boards.]** *Derev. Prom.* 9 (2), 1960 (7–9). [Russ.russ.] P.R.

Describes a series of tests on reducing the pressing time by spraying the outer layers of particles with water and hot pressing at ca. 150° C. Details are tabulated and graphed. This method reduced the pressing time from 1 min. to 0·3 min. per 1 mm. of thickness, but under production conditions the press time should be 0·4 min. per mm. of thickness, with 100 g. water sprayed per cu. m. of mat surface, and a press temperature of 150°. Increasing the press temperature to 170° reduced the pressing time to 0·2–0·25 min. per mm. Increasing the amount of water reduced the strength of boards 2 cm. thick. The method was much more effective with urea-formaldehyde than with phenol-formaldehyde resin binders. The method also improved the board surface and reduced water and moisture absorption.

5127. PETRI, V. N., and PERMIKIN, I. P. Primenenie petrolatuma pri proizvodstve plit iz drevesnyh častic. **[The use of petrolatum in the production of particle board.]** *Derev. Prom.* 8 (12), 1959 (11–2). 4 refs. [Russ.] P.R.

[Cf. *F.A.* 21 No. 2392.] To study the use of petrolatum as a substitute for paraffin [wax?] as a water-repellent additive in the manufacture of particle board, tests were made in which Pine sawdust (from barked logs) screened through holes of 2–10 mm. diam., was dried at room temperature to 8–12% moisture content and mixed with MF-17 resin; a petrolatum/water emulsion was then added. The material was pressed, at different temperatures and pressures, to a thickness of 18–21 mm., board made from the 2-mm.-diam. material being pressed at 100 kg./sq. cm. at $\ngtr$ 200° C. The results of static bending tests in relation to the amount of petrolatum used are tabulated in detail. For linear-swelling and moisture- and water-absorption tests, 30 × 20 mm. samples of the board were dried at 100–105° to a constant weight, then immersed in water, and weighed periodically. The results (given in graphs) indicated a sharp decrease in the water absorption of petrolatum-treated, vs. untreated, samples, especially in the first few hours after immersion, and similar trends were observed for the moisture absorption and linear swelling of treated samples (again especially in the early stages after immersion).

5128. SOKOLOVA, T. E., and TIMOFEEVA, O. G. **Biological protection of wood-chip panels**. *Stroitel′nye Materialy* 5 (10), 1959 (35–6). [Russ.] From *abstr.* in *Chem. Abstr.* 54 (10), 1960 (10313). P.R.

Describes a method of completely controlling *Coniophora cerebella* attack in hot-pressed chipboards, involving the addition of NaF or Na_2SiF_6 (0·5–1·0% of the weight of the chips) to the mixture. The same protection is obtained by adding 2% Na oxydiphenolate or 0·5% anthracene oil.

5129. NYSENKO, N. T., ČUDINOV, V. I., and ILESKIN, G. V. Drevesno-voloknistye plity iz otrabotannoj osmol′noj ščepy. **[Fibreboards from extracted chips of resinous [Scots Pine] wood.]**

Gidrol. lesohim. Prom. 12 (1), 1959 (24–6). 1 ref. [Russ.] P.R.

[Cf. *F.A.* 21 No. 2538.] Boards made from extracted, ungraded chips were more resistant to swelling in water, but were less strong than those from ordinary chips. Those made from extracted, steamed chips, and those from a mixture of extracted and ordinary chips were not inferior to boards made from ordinary chips.

5130. PEEL, J. D. **Pulp and paper manufacture in Malaya. Part III. The practicability of manufacturing fibreboard in Selangor**. *Malay. Forester* 23 (1), 1960 (5–33). 12 refs.

One of the recommendations in Part II of this series, viz. that the technical and economic aspects of manufacturing fibreboard in Selangor from *Hevea brasiliensis* and the tops and branches of timber trees should be investigated, has been carried out, and the results are presented in this paper. Yields from Rubberwood were rather low but Red Meranti hardboard of standard quality can apparently be made by heat tempering of unsized boards. [Cf. *F.A.* 20 Nos. 1232, 5317.]

5131. GUHA, S. R. D., SINGH, M. M., and MATHUR, G. M. **Pressed boards from Wattle wood (*Acacia mollissima*, Willd.)**. *Indian For.* 86 (3), 1960 (161–4). 5 refs.

Experiments indicate that it is possible to make boards in high yields and of satisfactory strength properties from Wattle wood by the Asplund defibration process. Best results were obtained when the material was steamed for 5 min., and defibrated for 10 min.

5132. KRPAN, J. Fizička i mehanička svojstva izolacionih ploča. [**Physical and mechanical properties of insulation boards**.] *Drvna Ind.* 11 (3/4), 1960 (34–40). 6 refs. [Croat.e.] P.R.

Tabulates and graphs data on the thickness, density, weight per unit of area, moisture content, water absorption, thickness swelling, compression strength, linear expansion and bending strength Jugoslavian insulation boards.

5133. DOSOUDIL, A. Weitere Untersuchungen über die Wasseraufnahme von Holzfaserplatten, insbesondere Hartplatten. [**Further investigations on the absorption of water by fibreboards, especially hardboards**.] *Holz Roh- u. Werkstoff* 18 (3), 1960 (106–11). 1 ref. [G.g.e.] P.R.

The factors examined were virtually the same as those already investigated for insulation boards [see *F.A.* 20 No. 2586]. Results, shown in graphs, indicate that in almost all cases thickness swelling was affected by the varying test conditions much less than water absorption.

863. Wood Hydrolysis. Saccharification

See also No. 4931.

5134. ČALOV, N. V., and ALEKSANDROVA, O. A. Gidroliz drevesiny gazoobraznym hloristym vodorodom pri atmosfernom davlenii. [**Wood hydrolysis with gaseous HCl at atmospheric pressure**.] *Gidrol. lesohim. Prom.* 12 (1), 1959 (14–8). 14 refs. [Russ.] P.R.

Gives in graphs and tables the results of a basic laboratory study on the method, using Scots Pine sawdust as the test material. It appears that the method, as applied in this study, is not advantageous because too much HCl was used, and new techniques should be worked out. Possible future trends in the method are discussed.

5135. HARRIS, J. F., SAEMAN, J. F., and ZOCH, L. L. **Preparation and properties of hydroxymethyl furfural**. *For. Prod. J.* 10 (2), 1960 (125–8). 12 refs.

Describes a new procedure for obtaining experimental quantities of this material, considered a promising product from the point of view of chemical conversion of wood residues, because of its great versatility. *From authors' summary*.

866. Utilization of Wood Extractives

See also Nos. 5129, 5145.

5136. FUCHS, W., and KISCHIO, W. **Electrochemical decomposition of wood**. *Erdöl u. Kohle* 12, 1959 (973–6). [G.?] From *abstr.* in *Chem. Abstr.* 54 (9), 1960 (9282). P.R.

Describes the heterogeneous reduction of pieces of Fir wood [unspecified], using a Pb cathode, to a mean particle size of 0·09 mm. before extraction to remove all resinous materials.

5137. ALEXA, G., CHIRIȚĂ, G., and CHIRIȚĂ, A. Asupra stabilirii calităţilor chimice-tehnologice ale extractului de lemn de stejar indigen obţinut prin extracţie simplă şi extracţie sulfitică. [**The chemical and technological properties of Oak wood extractives extracted by Na_2SO_3 and by water**.] *Buletinul Institutului Politehnic din Iasi* (*n.s.*) 4 (3/4), 1958 (217–28). 13 refs. [Rum.russ.f.] E.M.B.

A study was made of a method of extracting tannin from Oak [?*Quercus robur*] by the use of Na_2SO_3 at 0·2% of the weight of wood, employed at the Rumanian Argesul-Pitesti factory. Comparison of the extract so obtained with aqueous extracts and standard Russian and Jugoslavian extracts demonstrated its superiority: insolubles are reduced from 3 to 0·89%.

867. Destructive Distillation

5138. [**Preliminary report on charcoal burning in carp-shaped kilns in Chekiang province**.] *For. Sci., Peking* 1959 (2), (155–60). 2 refs. [Chin.]

A detailed local study of country practice. The 13 tree species most commonly used include species of *Cyclobalanopsis* and *Castanopsis*, *Lithocarpus glabra* and *Quercus glandulifera*. Each charge takes ca. 95 hours.

5139. WARD, J. C., and LANE, P. H. **Water sprays will shorten charcoal cooling time**. *Tech. Note Lake St. For. Exp. Sta.* No. 582, 1960. pp. 2. 2 refs.

Water was sprayed over the top of charcoal in a 3-cord kiln. Spraying began immediately after carbonization was complete, when kiln temperatures were ca. 900° F., and was continued intermittently for 4 hours until temperatures dropped to ca. 200°. A total of 650 gal. water was injected through two spray nozzles mounted on a pipe of ¾-in. diam. Weight of the charcoal in the kiln was 2,100 lb. Cooling time with spraying was 13 hours vs. a mean of 60 hours by natural heat loss.

89. Other ('Minor') Forest Products

892. Vegetable Products

892.1. Grass. Litter. Leaf Fodder etc.

See also No. 5150.

5140. Folgado, J. dos S. Crespo. Digestibilidade e valor alimentar das folhas do sobreiro. **[Digestibility and fodder value of Cork Oak leaves.]** *Estud. Inform. Serv. Flor. Aqüic. Portugal* No. 111*G*-3, 1959. pp. 17. 21 refs. [Port.e.] Limited distribution.

Tests were made of the fodder value for sheep of *Quercus suber* leaves during December and January. They were also chemically analysed. The results show that they have an extremely low nutrient value—total digestive nutrients 18·3%, and Scandinavian fodder units, 16·4 per 100 kg.

892.4. Bark Products. Tanstuffs. Cork

See also Nos. 4008, 4214, 4965, 5105, 5124.

5141. Strub, C., Iaroşinschi-Drabic, I., and Maga, C. Cîteva observaţii asupra extractului de coajă de brad (*Abies pectinata*) şi a aceluia de coajă de molid (*Picea excelsa*). **[The bark extracts of *A. alba* and *P. abies*.]** *Buletinul Institutului Politehnic din Iasi* (*n.s.*) 4 (3/4), 1958 (229–36 + 2 gphs.). 9 refs. [Rum.russ.f.] E.M.B.

The authors have established characteristic curves for the bark extracts of the two species in terms of the variation in the number of tannic particles.

5142. Kušner, M. V., and Sosnin, A. E. Ob ispol′zovanii kory splavnoj drevesiny eli dlja polučenija dubitelej. **[The utilization of the bark of floated Spruce for obtaining tannins.]** *Lesn. Ž., Arhangel′sk* 2 (1), 1959 (148–50). 3 refs. [Russ.]

Preliminary investigations at Archangel indicate that the tannin content of bark from Spruce floated for 2–3 months and then left in stacks for a considerable time is still quite high, averaging 5%. Further investigations with a view to commercial utilization are urged.

5143. Krakauer, E., Frankl, J., and Lewin, M. **The characterisation of the tannin of the Israel *Eucalyptus rostrata* and methods of its analytical determination**. *Repr.* from *Bull. Res. Coun. Israel* 8*A* (3), 1959. pp. 1. 2 refs. P.R.

Briefly reports an investigation of the possibility of applying to *E. rostrata* bark tannin a rapid spectrophotometric method originally developed for Wattle tannin, introducing modifications in the method consisting of adjustments of the wavelength region, the slit width of the Beckman D.U. spectrophotometer used, and changes in the concentration of Thompson's grey standardization solution.

5144. Roux, D. G. **Recent conclusions concerning the chemistry of Mimosa and Quebracho tans.** *Leder, Darmstadt* 10, 1959 (177). [G.?] From *abstr.* in *J. Soc. Leath. Tr. Chem.* 44 (5), 1960 (255). O.R.S.

Reviews recent work at the South African Leather Industries Research Institute and new methods used for isolating components. Discusses the parts played by new flavan-3,4-diols (leucoanthocyanidins) and flavan-3-ols (catechins), found in wood and bark of Mimosa and Quebracho, in the biogenesis of tannins. [Cf. *F.A.* 20 No. 3945.]

5145. Miller, R. W., and Beckum, W. G. van. **Bark and fibre products for oil well drilling.** *For. Prod. J.* 10 (4), 1960 (193–5).

Discusses the use of "silva-chemicals", such as extracts of Quebracho, Mangrove, Eucalypt wood, Redwood and other coniferous barks, spent sulphite liquors, and their derivatives, to control viscosity, gel strength and water loss of the drilling mud, and fibre additives, particularly bark fibres, to conserve the muds and prevent their leaking away.

5146. Cambie, R. C., and Cain, B. F. **Bark extractives of *Dacrydium cupressinum* Soland.** *N.Z.J. Sci.* 3 (1), 1960 (121–6). 21 refs.

Totarol, β-sitosterol, sequoyitol and a leucoanthocyanidin were isolated.

5147. Giral, F., and Rodriguez Hahn, L. **Echinocystic acid in [bark of] *Fouquieria peninsularis*.** *J. Chem. Soc.* May, 1960 (2373). 2 refs. O.R.S.

5148. Yoneichi, K., and Sawada, H. **Constituents of the bark of *Paulownia tomentosa*.** *J. Pharm. Soc. Japan* 79, 1959 (1226–8). [Jap.?] From *abstr.* in *Chem. Abstr.* 54 (4), 1960 (3609). P.R.

A brief account of constituents obtained following extraction of stem bark with methanol.

5149. Faber, H. B., Jr. **The methanol-extractable aromatic materials in the inner bark of *P[opulus] tremuloides*.** *Tappi* 43 (5), 1960 (406–13). 40 refs. P.R.

10 aromatic compounds were identified in the methanol extracts of Aspen inner phloem and stone-cell layers, and data on the seasonal variation of such substances as salicin, populin, tremuloidin, and ferulic acid in the various extracts, were obtained.

892.5. Medicinal Plants, Edible Plants, Insecticides from Plants, etc.

See also Nos. 5170, 5172.

5150. Haričev, V. Ceh vitaminno-hvojnoj muki. **[Factory lay-out for making vitamin flour from conifer needles.]** *Lesn. Prom.* 1960 (4), (10–1). [Russ.]

Describes the manufacturing processes and layout of a factory in Latvia which made 139 tons of the flour in 1959. [Cf. *F.A.* 19 No. 5007.]

5151. Raffauf, R. F., and Flagler, M. B. **Alkaloids of the Apocynaceae.** *Econ. Bot.* 14 (1), 1960 (37–55). 145 refs.

Lists, in a table, the 200 known alkaloids of the family, their formulae, physical properties and structures, and also gives the genera in which they are found, and literature references.

5152. Bhavanandan, V. P., and Wannigama, G. P. **Isolation of conessine from [the bark of] *Holarrhena mitis* R. Br.** *J. Chem. Soc.* May, 1960 (2368–9). 5 refs. O.R.S.

5153. Gorman, M., *et al.* **Alkaloids from Apocynaceae. III. Alkaloids of *Tabernaemontana* and *Ervatamia*. The structure of coronaridine, a new alkaloid related to ibogamine.** *J. Amer. Chem. Soc.* 82 (5), 1960 (1142–5). 23 refs. O.R.S.

[Cf. *F.A.* 21 No. 3868.] *E. coronaria*, *E. divaricata*, *T. undulata*, *T. psychotrifolia*, *T. oppositifolia* and *T. australis*.

5154. Silva, A. C. Correia da, Alves, A. Correia, and Prista, L. Nogueira. Nota prévia acerca da acção de casca de *Pentaclethra macrophylla* Benth. sobre o útero de cobaia isolado. **[Preliminary note on the effect of *P. macrophylla* bark on the isolated guinea-pig uterus.]** *Garcia de Orta, Lisboa* 7 (4), 1959 (773–83). 2 refs. [Port. f.e.] E.M.B.

Preliminary tests confirmed the fact, already known to the natives, that bark decoctions can promote abortion.

5155. Briggs, L. H., *et al.* ***Sophora* alkaloids. Part VI. The alkaloids of the bark and flowers of *S. microphylla*, and the isolation of diosmin from the flowers.** *J. Chem. Soc.* April, 1960 (1955–6). 6 refs. O.R.S.

Alkaloids identified from the bark and flowers were α-matrine, methylcytisine, cytisine, and sophochrysine. Anagyrine was found only in the flowers. The chief compound isolated from the flowers was identified as the flavone glycoside, diosmin.

5156. Krebs, K. G., and Griesinger, E. **Ingredients of the bark of *Exostemma caribaeum*.** *Arzneimittel-Forschung* 10, 1960 (34–60). [G.] From *abstr.* in *Chem. Abstr.* 54 (10), 1960 (10073). P.R.

Paper chromatographic tests of the extract indicated the presence of three flavone glycosides and of chlorogenic acid. No alkaloids were found, but mannitol was isolated.

5157. Gopinath, K. W., Govindachari, T. R., and Rao, U. R. **The alkaloids of *Zanthoxylum rhetsa* DC.** *Tetrahedron, Lond.* 8 (3/4), 1960 (293–5). 7 refs. [E.e.] O.R.S.

The isolation of (±)-evodiamine and the new quaternary alkaloid hydroxyevodiamine from bark is described. [Cf. *F.A.* 21 No. 3872.]

5158. Chatterjee, A., and Mitra, J. **Chemistry of rhetine and synthesis of rhetsinine, the alkaloids of *Zanthoxylum rhetsa* D.C.** *Sci. & Cult.* 25 (8), 1960 (493–4). 4 refs. E.M.B.

5159. Baumann, B. B. **The botanical aspects of ancient Egyptian embalming and burial.** *Econ. Bot.* 14 (1), 1960 (84–104). 65 refs.

Establishes the species of plants used in the preparation of the dead for burial, and considers some of the historical, commercial and botanical aspects of these plants as they applied to the ancient Egyptians. Many forest trees are involved.

892.6. Resin and Turpentine. Essential Oils. Fixed Oils and Fats. Gums. Latex. Dyestuffs. Sap Sugar

See also Nos. 4415, 5030, 5170–1.

5160. Alvarez, M. Vilas. Nota informativa de previsão da campanha resineira de 1959. **[Preliminary information on the Portuguese resin-production programme of 1959.]** *Estud. Inform. Serv. Flor. Aqüic. Portugal* No. 110-*F*, 1959. pp. 37. 5 refs. [Port.]

Includes some data on production and marketing in 1954–59.

5161. Pentegowa, W. A. [Pentegova, V. A.], and Lissina [Lisina], A. I. **[The resin acids of crude scrape resin of *Larix sibirica*.]** *Izvestija Sibirskogo Otdelenija Akademii Nauk SSSR, Moskva* 1958 (5), (57–65). [Russ.] From *abstr.* in *Holzforschung, Berlin* 14 (1), 1960 (26). [G.] P.R.

Gives details of their composition and properties.

5162. Briggs, L. H., and Cambie, R. C. **Chemistry of the Podocarpaceae—V. The identification of miropinic acid and isomiropinic acid from *Podocarpus ferrugineus* D. Don.** *Tetrahedron, Lond.* 8 (3/4), 1960 (356–9). 13 refs. [E.e.] O.R.S.

[Cf. *F.A.* 21 Nos. 3710–1.] Isomiropinic and miropinic acids from the resin were identified on reinvestigation as sugiol and isopimaric acid respectively. The resin acid of *Dacrydium biforme* was identified as isopimaric acid.

5163. Singh, R. **Rosha grass cultivation in Dehra Dun forests.** *Indian For.* 86 (4), 1960 (231–6).

Describes attempts to start a plantation in a 100-acre forest blank leased from the U.P. forest department in 1951. Results, including yields of oil, show promise.

5164. Moni, N. S., and Subramoniam, R. **Essential oil from *Eupatorium odoratum*—a common weed in Kerala.** *Indian For.* 86 (4), 1960 (209). 2 refs.

Known in Kerala as "Assam *Patcha*", this weed grows abundantly in Teak and rubber plantations in the forest. The physicochemical properties of the oil, which may have insect-repelling qualities, are listed.

5165. Rao, G. V. S. **Oil from the seeds of *Acacia decurrens* Willd.** *Curr. Sci.* 28 (10), 1959 (410). A.P.B.

Presents the results of a chemical analysis. The iodine value compares favourably with that of other well known drying oils.

5166. FAROOQ, M. O., *et al.* **Chemical study of oil from *Albizzia procera*.** *Bulletin de la Société de Chimie Biologique, Paris* 41, 1959 (901–6). [F.?] From *abstr.* in *Chem. Abstr.* 54 (5), 1960 (4782). P.R.

[Cf. *F.A.* 20 No. 1266.] Oil from the seeds of *A. procera* was analysed and its fatty-acid composition determined by the method of ester fractionation.

5167. ANDERSON, D. M. W., HIRST, E. L., and KING, N. J. **Uronic acid materials. II. Variation in composition of gum nodules from *Combretum leonense*.** *Talanta* 3, 1959 (118–26). From *abstr.* in *Chem. Abstr.* 54 (9), 1960 (9008). P.R.

The amount of the materials present in the gum nodules of *C. leonense* has permitted a study of the variations in constitution of both crude and purified forms of the gum. The variations found are much greater than can be explained by analytical error and are considered to indicate that inter-nodule differences in fine structure exist.

5168. BIRCH, A. J., *et al.* **Flavanones in *Angophora lanceolata*.** *J. Chem. Soc.* May, 1960 (2063–6). 8 refs. O.R.S.

The kino contains a small proportion of flavanones, including (—)-farrerol and (±)-angophorol.

5169. COOKE, R. G., and HAYNES, H. F. **Colouring matters of Australian plants. VII. Flavonoid glycosides from *Exocarpus cupressiformis* Labill.** *Aust. J. Chem.* 13 (1), 1960 (150–5). 34 refs. O.R.S.

The foliage contains dihydrokaempferol-7-rhamnoside (2·5%), kaempferol-7-rhamnoside (0·48%), kaempferol-3-rhamnobioside (0·16%), and quercetin-3-rhamnobioside (0·23%). Mannitol was also isolated and the presence of oleanolic acid (3%) was confirmed. *From authors' summary.*

892.7. Fruits. Seeds. Fibres, Yarns and Flosses

See also Nos. 5105, 5165–6.

5170. ANTÃO, L. A. RUY. *Anacardium occidentale* Linn.—estudo farmacognósico da casca e alguns ensaios sobre o óleo. Estudo previo. **[*A. occidentale*—a pharmacognostic study of the husk and some tests on the oil. Preliminary note.]** *Garcia de Orta, Lisboa* 7 (3), 1959 (551–67 + 5 plates). 28 refs. [Port.]

Presents data on botanical and morphological characteristics, and the results of investigations into the chemical composition of the husk and of some pharmacological tests.

5171. EDWARDS, M. G. **Cashew nut shell liquid [CNSL].** *Extr.* from *Annual Report, East African Industrial Research Board, Nairobi 1958/59*, 1959 (4–5). P.R.

Mechanical methods of shelling the nuts are being studied with the aim of using their content of CNSL (a vesicant toxic liquid amounting to ca. 30% of the shells) in the plastics industry. A method has been worked out whereby a > 80% yield of CNSL can be extracted by grinding and counter-current solvent extraction of the shells, and, if successfully developed, may make CNSL a valuable by-product.

5172. RAO, S. **Soap-nut, its collection and disposal in Giddalu Division [Andhra Pradesh].** *Indian For.* 86 (3), 1960 (165–8).

Describes in detail the collection and marketing of the fruit of *Sapindus laurifolius* var. *emarginatus*, a large tree usually occurring scattered over a large area. The fruit is used as a shampoo and also medicinally.

5173. DAS, N. R. **Note on adhesives from the proteins of *Aleurites montana*.** *Comp. Wood* 5 (4), 1958 (57–9). 1 ref. P.R.

Tabulates results of experiments made on the utilization of the oil-free residue of *A. montana* seed in an adhesive formulation (in which only protein-formaldehyde dispersions were tried).

5174. TURČEK, F. J. Der Nährwert einiger Waldsamen, die als Futter der Vögel und Säugetiere dienen. **[The nutritional value of some forest seeds that serve as food for birds and mammals.]** *Waldhygiene* 3 (5/6), 1960 (140–2). 3 refs. [G.]

Lists the calorific value of the seed of 6 conifers and 9 broadleaved species, with the number of birds and mammals known to eat them, and discusses their relative content of fats, carbohydrates, and proteins. The highest calorific value (6868 cal./g. dry matter) is shown for *Corylus avellana*, which contains 69% fats, the lowest for *Larix decidua* (2600).

9. FORESTS AND FORESTRY FROM THE NATIONAL POINT OF VIEW. SOCIAL ECONOMICS OF FORESTRY

90. General

See also No. 5230.

5175. GANGULY, J. K. **The bearing of recent European forest policies on the development of forestry in West Bengal, India.** *For. Bull. W. Bengal* No. 6, 1959. pp. 154 + 5 maps, 1 plan. 90 refs.

Contains chapters on: (1) problems of forest policy in W. Bengal, (2) forestry and land use in Europe, (3) policies and methods for management and extension of forests in Europe, (4) bearing of European policies on forestry development in W. Bengal.

5176. 5ème session de la Commission des forêts pour l'Asie et le Pacifique. Royaume de Laos. Rapport de politique forestière 1956–1957, 1957–1958, 1958–1959. **[Progress report on forestry in Laos, 1956/57–1958/59.]** [*Docum.*] *5th Sess. FAO Asia-Pacif. For. Comm., New Delhi 1960* No. *FAO/APFC* 60/4.19, 1960. pp. 11. [F.] Limited distribution.

5177. Igler, H., *et al.* Informe al gobierno de Chile de la Misión Forestal de la FAO. **[Report to the government of Chile by the FAO forestry mission.]** Expanded Technical Assistance Program, FAO, Rome. *FAO Report* No. 1192, 1960. pp. 46. 25 refs. [Span.span.]

Reports on (1) the plantations of *Pinus radiata* and the associated forest products industries, (2) the native forest, (3) transport and communications, and (4) training and research, and makes recommendations for the future, including a large-scale programme for the protection and rehabilitation of the native forests.

5178. Serevo, T. S. **Progress report on forestry in the Philippines, fiscal years 1957–1959.** [*Docum.*] *5th Sess. FAO Asia-Pacif. For. Comm., New Delhi 1960* No. *FAO/APFC* 60/4.17, 1960. pp. 17. Limited distribution.

Includes a list of exotics under trial, and notes on the utilization of lesser known species.

5179. Corbasson, M. Rapport à la commission des forêts pour l'Asie et le Pacifique F.A.O. Politique forestière poursuivie en Nouvelle Calédonie. **[Report to the Asia-Pacific Forestry Commission on forest policy in New Caledonia.]** [*Docum.*] *5th Sess. FAO Asia-Pacif. For. Comm., New Delhi 1960* No. *FAO/APFC* 60/4.20, 1960. pp. 11. [F.] Limited distribution.

5180. **Territory of Papua and New Guinea: Report on the operations of the Department of Forests for the year ended 30th June, 1958.** Department of Forests, Port Moresby. [1958?]. pp. 85.

Includes a statement of policy and forward planning, approved Dec. 1957.

902. History of Forests and Forestry

See also section 182.1 and No. 5222.

5181. Hammersley, G. **The Crown woods and their exploitation in the sixteenth and seventeenth centuries.** *Bulletin of the Institute of Historical Research, London* 30 (82), 1957 (136–61). Many refs. F.C.A.H.

An historical survey, including discussion of the supply problems of important individual industries such as shipbuilding, housing and fuel, and presenting *inter alia* regional receipts and profits from sales in selected years of 1543–59 and acreage and rent for coppice, 1604–12.

5182. Decencière Ferrandière, H. Origine des forêts domaniales. **[The origin of the [French] State forests. [An historical note.]]** *Rev. for. franç.* 12 (4), 1960 (237–49). [F.]

903. Forest Policy, General

See also No. 5191.

5183. Oekonomopoulos [Oikonomopoulos], A. Zielsetzungen der griechischen Forstwirtschaft. **[The aims of Greek forestry.]** *Holz-Zbl.* 85 (92), 1959 (1201). [G.]

A description of the present bad conditions, the reasons for them, and recommendations for the future, including control of grazing, training of forest workers and formation of proper forest workers' co-operatives, road-building, reforestation of 500,000 ha. in 20 years, Poplar and *Eucalyptus* growing outside the forests, etc. [Cf. *F.A.* 13 No. 2646.]

5184. La concurrence étrangère et la situation forestière du Québec. **[Foreign competition and forestry in Quebec.]** *Texte Conf. 39ᵉ Assembl. ann. Corp. Ingén. For. Québec* 1959 (116). 53 refs. [F. E.]

Includes papers and discussions on: Competition from the United States [F.] (*O. Lussier*); Foreign competition and forestry in Quebec [F.] (*L. P. Amiot*); Silviculture's role in meeting foreign competition [E.] (*W. A. E. Pepler*); [Timber measurement] Scales, legislators and technologists [E.] (*W. H. Martin*); The private forest, a source of pulpwood [F.] (*R. Delisle*); Integrated utilization of forest products [F.] (*J. Risi*); Policy throughout the world [F.] (*G. Maheux*).

904. General Regional Accounts of Forests and Forestry

See also No. 4796.

5185. Dent, T. V. **Forestry in Yorkshire.** *Forestry* 33 (1), 1960 (74–100 + 4 photos, 1 map). 12 refs.

The history of Yorkshire's woodlands is briefly described, and the site factors influencing tree growth are considered in general terms. Problems concerning the economics and administration of the woodlands are discussed, and statistics and facts regarding the extent, composition, and management of both private and State-owned woodlands in Yorkshire and of forest research in the county are recorded. *From author's summary.*

5186. Notes forestières sur l'ouest de l'U.R.S.S. de Leningrad à la Georgie. **[Forestry notes on the western U.S.S.R. from Leningrad to Georgia.]** *Rev. for. franç.* 12 (6), 1960 (382–407). [F.]

Notes on observations made during a tour by French foresters in Sept.–Oct. 1959.

5187. Offner, H. Die Forst- und Holzwirtschaft in Griechenland. **[Forestry and forest industry in Greece.]** *Holz-Zbl.* 84 (133), 1958 (1692–3). [G.]

A report on a visit to the country in connexion with a meeting of the International Union for the Conservation of Nature and Natural Resources, supplemented by FAO statistics etc., discussing forest area, ownership, legislation, administration, the chief species of the main forest zones (cool, temperate and subtropical) and the chief wood industries. Sawmill annual output is given as 350,000 cu. m. As an illustration of afforestation problems, the author contrasts a successful plantation of Cypress, *Pinus pinea*, *P. halepensis*, Olives, Robinia, etc. planted and regularly watered by volunteer labour with an unirrigated plantation that had failed.

5188. Sbornik posveten na postiženijata na lesotehničeskata nauka za 15 godini narodna vlast.

[Collected papers on the achievements of forestry science in the 15 years of Communism [in Bulgaria].] Visš Lesotehničeski Institut, Sofia. 1959 (1960). pp. 149. Many refs. [Bulg.]

A collection of 14 articles on progress since 9 Sept. 1944 in silviculture, forest management, mensuration, dendrology, afforestation, forest protection, game management, erosion control, forest economics, amenity planting, forest utilization, timber transport, and the woodworking and furniture industries.

5189. McKee, R. G. **Canada's Pacific forests.** *Unasylva* 13 (4), 1959 (174–83).

An account of forestry in British Columbia, with particular reference to its role in the Canadian economy and to the sustained-yield policy put into practice from 1949. Present resources, and production and planting figures for 1949–58, are listed. The accessibility of forests, and the related problem of fire suppression are discussed, with an analysis of fire damage for 1958.

5190. **Alaska forest resources.** *J. For.* 58 (6), 1960 (435–77). 21 refs.

Includes the following articles: Alaska—modern pioneering (*B. F. Heintzleman*); National forests in Alaska (*M. B. Bruce*); The Alaska public domain (*E. V. Zumwalt*); Forest and range fire control in Alaska (*R. R. Robinson*); Fire as an ecological factor in the boreal forest of Alaska (*H. J. Lutz*); The forest-wildlife resources of Alaska (*U. C. Nelson*); Alaska forestry—a research frontier (*A. E. Helmers*); The timber industry and industrial forestry in Alaska (*A. M. Byers*).

5191. Hinojosa Ortiz, M. Los bosques de México. Relato de un despilfarro y una injusticia. **[The forests of Mexico. A report of maladministration and injustice.]** Instituto Mexicano de Investigaciones Económicas, Mexico, D.F. 1958. pp. 168 + 12 photos. 43 refs. [Span.]

Part I reviews the present situation with regard to legislation, administration, the forest products industries, the destruction of the forests both public and private, marketing and economic aspects, forestry as a profession, and the present feeling of insecurity in the industry. Part II discusses and makes suggestions for a new forest policy, a stable and progressive industry, and the reform of legislation.

5192. Carlson, N. K. **Honaunau forest.** *Amer. Forests* 66 (4), 1960 (16–9, 53, 55–8).

An account of the 10,000-acre Honaunau forest in the Kona district of Hawaii, its high rainfall and depleted stock of native timber trees. *Fraxinus uhdei*, *Cedrela toona* var. *australis* and *Eucalyptus saligna* have been successfully introduced, and *Alnus nepalensis* and *Flindersia brayleyana* are regarded as promising. Trials with valuable native species and further exotics continue.

905. Forest Statistics and Resources

See also Nos. 5216, 5220, 5235.

5193. Ergebnisse der österreichischen Waldstandsaufnahme 1952/56. Band 3. Niederösterreich. **[Results of the Austrian forest survey 1952–53. Vol. 3. Lower Austria.]** Forstliche Bundes-Versuchsanstalt Mariabrunn in Schönbrunn, Vienna. 1959. pp. [5] + 154 + 69. [G.] [Cf. *F.A.* 19 No. 5038.]

5194. Ergebnisse der österreichischen Waldstandaufnahme 1952/56. Band 4. Oberösterreich. **[Results of the 1952–56 Austrian forest survey. Vol. 4. Upper Austria.]** Forstliche Bundes-Versuchsanstalt Mariabrunn in Schönbrunn, Vienna. 1960. pp. [5] + 113 + 114 + 59. [G.] [Cf. *F.A.* 19 No. 5038.]

5195. Braun, R. Leistungsgrenzen der österreichischen Forstwirtschaft. **[Production potential of Austrian forestry.]** *Holz-Kurier, Wien* 15 (17), 1960 (1–4). [G.]

A critical discussion of the methods and results of the Austrian forest survey, including the controversial figure of 8·5 million cu. m. for the total allowable annual cut, arguing that the methods used, particularly those of yield determination, cannot adequately take into account the extreme diversity of age structure, standing volume, increment etc. found as between regions and ownership groups, and pleading for a continuous sample inventory. [Cf. *F.A.* 19 No. 3685.]

5196. Cointat, M. Inventaire cartographique des friches et forêts du département de l'Aube. **[A cartographic inventory of the clearings and forests of the Departement of Aube.]** *Rev. for. franç.* 12 (6), 1960 (374–81). [F.]

With a view to a complete survey showing the changes in the forest area since 1912, a pilot survey has been made for one Departement. The areas of hardwoods and conifers, agricultural land, and different types of forest clearing (bare, scrub, natural regeneration of hardwoods etc.) are shown by different colours and symbols on a 1 : 200,000 map, the data being largely derived from aerial photos.

5197. Garcia Diaz, E. La riqueza forestal de Asturias y su porvenir. **[The forest wealth of Asturias and its future.]** *Montes, Madrid* 16 (92), 1960 (139–43). [Span.]

Reviews the financial yields to be expected from *Eucalyptus globulus*, *Pinus radiata*, *P. pinaster*, Beech, Oak and Chestnut in this region, and gives figures for total forest area (815,600 ha.) by ownership classes and by stand composition. Total outturn from fellings of all species in 1958 was 436,000 cu. m., a low figure considering the extent of the forests. Reasons for this low production include fire, ill-organized grazing and bad management. The necessity for efficient and co-ordinated land management is discussed.

5198. Taksering av Norges skoger utført av Landsskogstakseringen: Østfold og Akershus fylker, revisjonstaksering 1957. **[The survey of Norway's forests made by the National Forest Survey: Østfold and Akershus counties, revised survey 1957.]** Grøndahl & Søn, Oslo. 1959. pp. 309. [Nor.]

Presents the tabulated data with an analysis and comparison with previous surveys [cf. *F.A.* 19 No.

3683]. Includes papers by various authors on soils, vegetation types, management, regeneration counts, amounts felled, and sources of error in the survey.

5199. BUKSTYNOV, A. D. Lesnye resursy SSSR i mira. **[Forest resources of the U.S.S.R. and the world.]** Izdatel′stvo Ministerstva Sel′skogo Hozjajstva SSSR, Moscow. 1959. pp. 63. 23 refs. [Russ.]

Tabulates data on forest area, productivity (stocking and increment), forest composition, organization, and utilization in the U.S.S.R., and more briefly, the area, standing volume, and increment of forests by continents and countries.

5200. BOWLES, W. D. **New data on the timber industry of the U.S.S.R.** *J. For.* 57 (11), 1959 (822–4). 6 refs.

A detailed critical analysis of Soviet statistical data [cf. *F.A.* 20 Nos. 1309, 4623].

5201. GUICHON, A. La superficie des formations forestières de Madagascar. **[The area of forest formations in Madagascar.]** *Rev. for. franç.* 12 (6), 1960 (408–11). [F.]

From the somewhat discrepant figures available, calculates that there are 12½ million ha. of forest only slightly or not at all degraded, and ca. 4,300,000 ha. of degraded forest. The first category represents 21% of the whole area of the island; the two together amount to 28%.

5202. COZZO, D. Ubicación y riqueza de los bosques espontáneos de "pino" Paraná (*Araucaria angustifolia*) existentes en la Argentina. **[Location and resources of the natural forests of Paraná Pine in Argentina.]** *Rev. for. argent.* 4 (2), 1960 (46–54). [Span.]

In the light of information additional to that already published, the author reviews the extent and distribution of Paraná Pine forests in Argentina. A map shows the extent and location of the state forests, and estimates are presented of the standing volume of merchantable timber. Private forests are also listed. The estimated volume of standing timber in state forests is ca. 1,800,000 cu. m., and in the private forests ca. 26,000 cu. m. If resources are to be maintained, the annual cut should not exceed 35,000 cu. m., only half the present requirements of the wood-using industries of Misiones. The author believes that the solution lies in a planned programme of reforestation, meanwhile extracting the minimum possible to keep up supplies to the industry.

5203. **Window on wood.** Division of Timber Supply Economics, Forestry and Timber Bureau, Melbourne. 1959. pp. 23.

The booklet presents statistical information, in graphs and tables, on many aspects of forestry and forest products in Australia, with the aim of assisting the forecast of Australia's future timber requirements, and of the supplies likely to be available to meet them. The figures for the years up to and including 1957–58 are complete, but some of those for 1958–59 are subject to amendment as fuller information becomes available.

906. Direct Economic Significance of Forests (Position of Forests and Forestry in the National Economy)

5204. **Forest industry opportunities in rural development.** *Agric. Inform. Bull. U.S. Dep. Agric.* No. 222, 1960. pp. 27.

Points out, with illustrations and case histories, the possibilities of profitable employment and enterprise in the improvement of woodlands and small wood industries, as a contribution to the economy of low-income farming communities in or near forests.

907. Indirect Significance of Forests (Rural Amenity, National Parks, Forest Influences etc.)

See also section 116 and No. 4234.

5205. MILES, R. **Forestry and landscape in the Exmoor National Park.** *Forestry* 33 (1), 1960 (13–8 + 3 photos). 2 refs.

To safeguard scenery and other amenities, and to win sympathy for forestry, the writer advocates a much profounder approach to proposals for afforestation. These should not be considered piecemeal nor separately from other possible developments, but each region of importance should have its own comprehensive landscape development plan drawn up to conform with certain guiding principles. Having been entrusted with the preparation of such a plan for the Exmoor National Park, the writer uses this as an example and enunciates briefly the ten principles which guided him in its preparation. He then explains, without giving details of particular areas, their effect on the size, shape, and constitution of the afforestation which he felt able finally to propose for the area. *Author's summary.*

91. Land Use, Land-Use Policy (including Afforestation Policy)

See also Nos. 3960, 5230, 5235–6.

5206. BEST, R. H. **Studies in rural land use: Report No. 4. The major land uses of Great Britain. An evaluation of the conflicting records and estimates of land utilisation since 1900.** Wye College, Ashford, Kent. 1959. pp. xii + 113 + 1 tbl. Many refs.

5207. WALKER, K. R. **The Forestry Commission and the use of hill land.** *Repr.* from *Scottish Journal of Political Economy, Glasgow* 7, 1960 (14–35). Many refs.

Briefly discusses the actual method (embracing economic, social, strategic, and, in the case of land, ecological, factors) used by the Government to reconcile, "in the national interest", the competing demands for land by the Forestry Commission and by agriculture, and examines the pattern of land allocation that has emerged. By contrast, the purely economic criteria applicable are considered, and statistical evidence presented indicating the broad pattern of land allocation between forestry and agriculture that would result, if such criteria alone were applied. The consequent supply position (which would greatly improve for forestry) is compared with the actual position and suggestions are made towards reconciling the Government's planning approach with the purely economic one.

5208. **Land utilization and conservation in the Scottish Highlands**. *Institute of Biology Journal, London* 7 (1), 1960 (7–27). 21 refs.

Summaries of papers read at a Symposium at Glasgow in Sept. 1959, including the following: Problems of conservation in the Highlands (*W. H. Pearsall*); Soil conditions in Highland areas (*R. Glentworth*); Soil erosion in Scotland (*R. M. Gorrie*); The role of bracken in Highland ecology (*K. W. Braid*) [includes control]; Peat afforestation (*M. V. Edwards*) [discussing *inter alia* susceptibility to windblow and the possible effect of unilateral root development along plough furrows, and the possibility that tree growth on ploughed peat and peaty podzols may be limited by water shortage]; and Scottish soils in relation to afforestation (*W. O. Binns*) [including a mention of his researches into nutrient contents of deep peat, showing that the content of K, Mn and Ca in the surface vegetation is greater than that in the surface layers of the peat].

5209. ECKMÜLLER, O. Integration der Agrar- und Forstpolitik. **[Integration of agricultural and forestry policies.]** *Schweiz. Z. Forstw.* 111 (6), 1960 (277–87). [G.f.]

Stresses the need for close collaboration between agricultural and forestry planning and advisory services in the structural changes taking place in Austrian farming, e.g. the growing reversion of land to forestry with reduction of the agricultural areas owing to shortage of labour, mechanization and higher yields per unit area; the rehabilitation of forests freed from pasturage; and the planning of agricultural investments financed from timber yields so as to balance the interests of forestry and agriculture. An example of such collaboration in one of Styria's problem areas is given.

5210. GOLOB, R. Ekonomičnost gozdne paše na Pokljuki in severnih Bohinjskih planinah. **[The economics of forest grazing on the Pokljuka and on the N. Bohinj Alps [Slovenia].]** *Gozd. Vestn.* 18 (3/4), 1960 (65–81). 2 refs. [Sloven.g.]

Analyses the position and concludes that pastoral husbandry should be kept separate from forestry.

5311. STREHLKE, E. G. Aufforstung—eine Voraussetzung des Aufstiegs der griechischen Volkswirtschaft. **[Afforestation—a pre-condition for economic progress in Greece.]** *Holz-Zbl.* 85 (83), 1959 (1089). [G.]

A general article on the need for, and the problems of, afforestation, including the extent of scrub, the goat and sheep problem (goat population estimated at 8 million, sheep at 24 million vs. a total human population of 8 million), forest rights (consuming 2·8 million cu. m. out of a total annual cut of 4·5 million) etc. From 1945 to 1958 only 600 ha. were afforested, mostly in the better-wooded forest districts. [Cf. *F.A.* 17 No. 1091.]

5212. KHALIL, M. A. K. **Forest and range problems in waste lands of Pakistan**. *Pakistan J. For.* 10 (1), 1960 (67–77).

5213. CHIEN, H. La reforestation en Chine. **[Afforestation in China.]** *Rev. int. Bois.* 27 (260), 1960 (3–5). [F.]

An outline of Chinese afforestation and soil conservation projects 1950–58. [Cf. *F.A.* 16 No. 1306; 20 Nos. 3139, 5427.]

5214. ROMNEY, D. H. [Editor.] **Land in British Honduras. Report of the British Honduras Land Use Survey team**. *Colonial Research Publications, London* No. 24, 1959. pp. vii + 327 + 18 photos, 8 dgms., 13 sketchmaps, 7 maps. Price 55*s*.

Includes three maps, each in two sheets (scale 1 : 250,000) showing soils, vegetation and potential land use, with detailed comments, legends, and descriptive notes. The pattern of vegetation was found to reflect accurately the nutrient and moisture status of the soils (the units of vegetation being subdivided by the relative abundance of lime-loving species) and the six main climatic regions (upland and lowland, dry, moist and wet zones). It is thought that ultimate prosperity will largely depend on forestry development and rehabilitation (including reforestation in high forest degraded by the *milpa* system of shifting cultivation) and grassland farming. Recommendations include the extension of forest reserves, and legislation to prevent over-exploitation.

5215. MAACK, R. Die Veränderung der Naturlandschaft und ihre Folgen in Nordparaná durch die Besiedlung. **[Changes in the natural vegetation of N. Paraná through human settlement, and the consequences.]** *Mitt. Bundesforsch. Anst. Forst- u. Holzw.* No. 45, 1960. pp. 7. [G.]

Discusses, with illustrations, the consequences of forest destruction, which by 1955 had reduced the area of tropical rain forest by nearly 50% and that of the *Araucaria* forest by 66% [cf. *F.A.* 17 No. 2628]. These include erosion—catastrophic in places, adverse changes in climate, ground-water levels and stream-flow, and the rapid exhaustion of the fertility of forest soils under Coffee plantations.

92. Forest Ownership and Ownership Policy

See also Nos. 5181–2.

5216. KASAI, K. **[A study on the establishment of the forest land ownership and its regional particularity.]** *Bulletin of the College of Agriculture, Utsunomiya University* 4 (1), 1958 (53–70). [Jap. e.*e.*] C.G.B.

Traces the history of forest land ownership in Japan in relation to social and economic conditions, with particular reference to agriculture. Tables give total forest areas in different prefectures, and ratios of different ownership classes to the total in 1909, 1930 and 1957. *From author's summary.*

5217. SANO, S. **[On the history and the present condition in municipal management forests and property ward management forests.]** *Sci. Rep. Kyoto Prefect. Univ.* (*Agric.*) No. 11, 1959 (126–34). 8 refs. [Jap.jap.*e.*]

Discusses the development of public forest ownership in Japan, with details of municipal forest holdings throughout the country.

5218. STEPHANOS, A. Protypos dasoponia elatodasous Mainalou. Dikaios epainos stous dasikous. **[Model forestry in the Mainalon Fir [*Abies cephalonica*] forest. A just tribute to the forest service.]** *Das. Chron.* 2 (15), 1960 (674–5). [Gk.]

Describes how this estate, rescued from over-exploitation and abuse, and rehabilitated, is run entirely by the Forest Service, with its own sawmill and seasoning facilities. The stands are well tended, are regenerating naturally in many places, and gaps are being filled with *Pinus nigra* and *Abies cephalonica*. There are many thriving exotics, e.g. *Robinia pseudoacacia*, and there is an excellent network of forest roads.

5219. Forstliches aus Eritrea. **[Forest news from Eritrea.]** *Allg. Forstztg.* 71 (11/12), 1960 (127). [G.]

Briefly outlines the provisions of a scheme for the formation of village forest committees, whose duty it will be to select suitable planting sites, to compensate the owners, and to plant village forests of 1 to 5 ha. with plants to be supplied free by the provincial administration and unpaid village labour. There are provisions for prizes for the most successful plantations and fines for unsuccessful ones.

5220. JAMES, L. M. **Farm woodlands and the timber economy of Michigan.** *Quart. Bull. Mich. Agric. Exp. Sta.* 42 (3), 1960 (563–83). 13 refs.

Farm woodlands form 20% of Michigan's forest area, and 21% of its farm area. [Cf. *F.A.* 19 No. 1242.]

93. Public Supervision and Regulation of Forestry, including Legislation for these Purposes

See also Nos. 4214, 5191.

5221. HOCKE. Bisherige Ergebnisse der Forsteinrichtung im Bauernwald des Kammerbezirkes Kurhessen. **[Results to date of management plans for farm woodlands in Kurhessen [N. Hesse].]** *Allg. Forstzeitschr.* 15 (24), 1960 (342–5, 348). [G.]

The forest law of Hesse favours voluntary associations of owners managing their woodlands under approved simplified joint working plans which allow each owner as much freedom of action as possible, but provide for compulsory grouping if necessary. The joint plans are built up from plans for the individual owners. In the 65 districts so far dealt with, growing stock and c.a.i. were higher than expected and the annual cut was fixed at 3·1 cu. m./ha., but fragmentation was an urgent problem (4834 ha. were split into 8723 lots with 2890 owners).

5222. JUAN-SENABRE, E. P. Disposiciones penales en materia de montes. **[Penal measures concerning forests.]** *Montes, Madrid* 16 (92), 1960 (159–63). [Span.]

A brief historical review of Spanish dispositions with regard to offences connected with the forests, from the year 681 to the present day.

5223. Bulgariens neues Forstgesetz. **[Bulgaria's new forest law.]** *Holz-Zbl.* 86 (72/73), 1960 (1008). [G.]

Discusses the main features of a law enacted in Nov. 1958.

5224. **Pakistan (East). Ordinance No. XXXIV to provide for the conservation of private forests and for the afforestation in certain cases of waste lands in East Pakistan—9 May 1959.** In *Food agric. Leg.* 8 (3), 1959: pp. 25.

5225. **The Forests Ordinance 1953. Forest (Amendment No. 2) Rules 1958. No. S.126.** *Sarawak Government Gazette, Kuching (Part II)* 13 (18), 1958 (187–8).

5226. ROBERTS, M. J. G. **Liability for errant acorns.** *J. Land Agents' Soc.* 59 (5), 1960 (195–200) 36 refs.

Discusses the legal points involved and possible precedents in a recent case in which a farmer whose bullocks had been poisoned by eating acorns from an Oak tree overhanging his land claimed (unsuccessfully) against the owner of the land on which the tree stood.

94. Other Methods to Implement Forest Policy

See also No. 5219.

941. State Subsidies etc.

See also No. 4799.

5227. **Grants for woodland owners.** H.M. Forestry Commission, London. Revised 1959. pp. 12.

Planting and maintenance grants; loans; technical advice.

945.2. Publicity, Propaganda (including Demonstration Forests)

5228. HILF, H. H. Der Universitätsforst Pertuli—ein Motor der griechischen Forstwirtschaft. **[The University forest of Petrouli—a driving force in Greek forestry.]** *Holz-Zbl.* 85 (91), 1959 (1191–2). [G.]

Describes this instructional and model forest (attached to the University of Salonica), of ca. 3000 ha. situated at 1100–1500 m. alt. in the Pindos mountains, Thessaly, its history, present stocking, increment etc. The chief species is *Abies borisii-regis*, regarded by local foresters as a natural *A. alba* × *A. cephalonica* hybrid. It will grow in the open without shade, and is resistant to drought and frost. There is a model sawmill, a students' hostel, and a forest workers' school.

945.3. Education. Training. (Including Educational Tours and Information on Careers)

5229. Forskning och högre utbildning på skogsbrukets område. **[Research and higher education in forestry.]** *Skogen* 47 (11), 1960 (214–6). [Sw.]

Summarizes the majority report of a special committee, appointed in 1956, and the reservations of individual members. The main proposal is that the research and teaching functions of the Skogsforskningsinstitut and the Skogshögskola should be combined.

5230. Curso livre de silvicultura—lições proferidas no Instituto Superior de Agronomia, 28 de abril a 7 de maio de 1959. **[Open course in forestry—lectures given at the Instituto Superior de Agronomia, 28th April–7th May, 1959.]** Direcção Geral dos Serviços Florestais e Aqüicolas, Lisbon. 1959. pp. 95. 6 refs. [Port.]

Gives the texts of the following papers: Wood—basic material of the pulp industry (*L. de Seabra*); Forestry programmes and technical assistance—general considerations and examples (*A. M Azevedo Gomes*); Forestry and the protection of nature (*C. M. Baeta Neves*); Forest science in the face of modern demands (*M. Gomes Guerreiro*); Mineral fertilizers and silviculture (*A. L. Franco de Oliveira*).

5231. SCHWARZ, H. Bundesgesetzliche Bestimmungen über die Berufsausbildung der Arbeiter in der Forstwirtschaft Österreichs. **[Federal laws on the training of forest workers in Austria.]** *Öst. Vjschr. Forstw.* 101 (1), 1960 (20–30). [G.]

Describes the existing grades of forest workers—assistant, skilled worker, and 'master' (foreman), the conditions of apprenticeships, and compulsory and voluntary training courses, and lists the existing schools for forest workers and those for rangers.

5232. NEUENSCHWANDER, R. Erfahrungen bei der Ausbildung von Waldarbeitern in der Waldpflege. **[The training of forest workers in tending young stands.]** *Schweiz. Z. Forstw.* 111 (6), 1960 (300–12). [G.f.]

Makes suggestions, based on practical experience, on the kind of basic questions workers should be taught to ask themselves to enable them to work with little or no supervision in tending regeneration and thickets, and outlines a programme for a ten-day course.

945.4. Research

See also Nos. 4831, 4834–6, 5228–9.

5233. GRIESAU, H. D. Forschungsvorhaben der Landbau-, Ernährungs- und Forstwissenschaft. **[Research projects in agricultural, food, and forestry science.]** Forschungsrat für Ernährung, Landwirtschaft und Forsten, Bayerischer Landwirtschaftsverlag, Munich. [1960?] pp. 212. [G.] Price *DM.* 18.50. From *review* in *Holz-Zbl.* 86 (79), 1960 (1121).

A classified list of research projects of all W. German research stations and sections.

5234. **Forest Department North Borneo: Research Programme 1960–1964.** Forest Department, Jesselton, N. Borneo. 1959. pp. 18.

The first comprehensive programme of forest research to be prepared for the Colony of N. Borneo. It has purposely been modelled on similar programmes published by the Forest Departments of the Federation of Malaya and of Sarawak.

946.2. Conferences and Excursions

See also Nos. 3945, 5237.

5235. **Forest Economics Conference, School of Forestry, Mississippi State College, January 17, 1958.** Mississippi State College, State College, Miss. 1958. pp. [42].

A conference chiefly on future prospects in Mississippi, with papers by *D. W. Parvin* and *T. E. Tramel* on land use, *P. R. Wheeler* on resources, *R. M. Nonnemacher* on pulpwood demand, *T. DeWeese* on sawtimber demand, and *J. E. Moak* on special problems of the N. Mississippi pulpwood market.

95. Forest Taxation

See also Nos. 4799, 4810.

5236. VOCE, B. Esenzioni fiscali in favore dei rimboschimenti volontari. **[Tax exemptions in favour of voluntary afforestation.]** *Monti e Boschi* 11 (4), 1960 (165–70). [It.f.e.]

Examines some particular cases and the possible application to them of tax exemptions allowed by the Italian Government.

5237. **Taxation and conservation of privately owned timber. Proceedings of a conference held at the University of Oregon January 27, 28, 1959.** Bureau of Business Research, University of Oregon, Eugene, Oregon. [1959?] pp. iv. + 95.

Contains introductory papers and discussions examining chiefly the contribution which economic theory can make to an understanding of the problem as it affects the N.W. Pacific region, as follows: Social objectives of conservation of natural resources with particular reference to taxation of forests (*S. V. Ciriacy-Wantrup*); Taxation as a tool for accomplishing social objectives in forest management (*A. D. Scott*); Inheritance taxes (*M. R. Benedict*); Forest yield and severance taxes (*R. Campbell*); The property tax on forest land and timber (*E. T. Williams*); and The impact of capital gains taxes on timber resource utilization (*W. J. Mead*).

96. Forest Labour Questions. Labour Questions in Wood Transport and the Wood Industries

See No. 4441.

FORESTRY THE WORLD OVER

References: 1. *Allgemeine Forstzeitschrift*, Munich; 2. *Angewandte Chemie*, Weinheim/Bergstrasse; 3. *Australian Timber Journal*, Sydney; 4. *Daily Telegraph*, London; 5. *Empire Forestry Review*, London; 6. *FAO Press Release*, Rome; 7. *Forestry Adviser's Newsletter*, Colonial Office, London; 8. *Forst- und Holzwirt*, Hanover; 9. *Forst und Jagd*, Berlin; 10. *Holz-Kurier*, Vienna; 11. *Holz Roh- und Werkstoff*, Mering bei Augsburg; 12. *Holz Zentralblatt*, Stuttgart; 12*a*. *India News*, London; 13. *Industrial and Engineering Chemistry*, Washington; 14. *Journal of Forestry*, Washington; 15. *Le Soir*, Brussels; 16. *Nature*, London; 17. *Nigeria Trade Journal*, Lagos; 18. *Record of Research*, E.A.A.F.R.O., Kikuyu, Kenya; 19. *Skogen*, Stockholm; 20. *Swedish International Press Bureau Release*, Stockholm; 21. *Timber Technology*, London; 22. *Trees Magazine*, Olmsted Falls, Ohio.

International. A Frenchman, M. le Chatellier, has been appointed to look after forestry interests within the framework of the European Common Market. His tasks are to prepare measures for co-ordination in forestry and to discuss their implementation on a national basis, and to maintain contact with all Common Market activities which directly or indirectly affect forestry interests (**8**; 16.8.60).

A new body, the International Wood Research Society, held its first meeting recently in Paris under the auspices of FAO. The society is to promote the advancement of knowledge and the more efficient utilization of wood and wood products. Dr. B. Thunell (Sweden) is the Society's first President (**21**; Aug. 1960).

The first international training course in aerial forest inventory ever to be given is being held at Kuala Lumpur, and at Sandakan in British N. Borneo, from 1 August to 31 October. It has been organized by FAO in cooperation with the governments of the Federation of Malaya and British North Borneo. Some 25 foresters were expected, from the Philippines, British Solomon Is., Burma, Thailand, Japan, Indonesia, Malaya, and Korea. The first two months of the course are being held in Malaya and will be largely theoretical, with one field trip to a Mangrove forest area. Participants will use aerial photographs on various scales (from 1/10,000 to 1/50,000) for forest inventory and survey work, including ground checks and mapping. Their suitability will be determined for various fields of investigation—not only general forest use (inventory, road-building, detection of disease, fire areas, etc.), but for applications in land-use planning, watershed management, soil conservation, and regulation of shifting cultivation and grazing. The final month will be spent in British N. Borneo and will be entirely devoted to field trips within the tropical forest area of that region (**6**; 29.7.60).

Argentina. Mo och Domsjö, according to a report from the International Finance Corporation, is to invest at least 1·5 million kronor in the Argentine company, Papetera Rio Paranà S.A., and is also to give technical help. A new sulphite mill is to be established, for the manufacture of dissolving and bleached sulphite pulp. This will increase the Argentine company's capacity from 6000 to 17,400 tons annually. It is estimated that the whole project will cost about 5·3 million dollars (**19**; 8.7.60).

Australia. As part of the modernization programme of Penola Timbers Ltd., Mt. Gambier, a 48-ft.-long twin-opening pressure cylinder of 8 ft. internal diameter, having a max. capacity of 12,000 super ft. in any one charge, has been installed. It is operated usually at 200 lb./sq. in. and takes about 2 hours to impregnate 1-in. Radiata Pine to a net dry retention of 0·35–2·00 lb./cu. ft., no heating equipment being needed, as the solution is used cold. Designed for complete ease of loading, the cylinder has a door at each end, and, it is claimed, successfully treats both sawn and round timbers covering a wide range of products such as stumps, sub-floor and framing timbers, posts, poles, palings, and marine and mining timbers (**3**; April 1960).

Austria. Preparations are being made to use an East German drainage plough in the afforestation work on waterlogged and compacted unproductive meadows now in progress near the Austrian-Czech border. This machine digs the ditch, forms a perforated plastic pipe, lays it, and fills the ditch again, all in one operation (**10**; 21.7.60).

At the Austrian Wood Fair, Klagenfurt, an Austrian inventor showed boards with a half-annular cross-section cut by a special bandsaw along the lines of the annual rings of half-logs. He claims that this method, which preserves the structure of the wood, greatly increases strength and dimensional stability, as well as outturn per log, and that, in addition to all traditional bearing and encasing purposes, his curved boards can be used for novel, self-supporting roofs, for pipes, and many other uses (**10**; 1.9.60).

A process for the continuous production of blockboard, either fully or partly automatic, has been developed in Austria, in which the core is held under pressure and the outer layers in tension in such a manner that resistance to temperature and moisture fluctuations is greatly improved (**10**; 11.8.60).

Belgium. A new, non-profit-making association, the Centre Belge du Bois, was recently inaugurated at Saint-Hubert. Its object is to promote progress in forestry and the forest products industry by technical assistance and research on new markets and uses for wood, work studies, and the extension of professional organizations. The Government has made available to the new organization the buildings and lands of the Abbaye de Saint-Hubert, and it is to be subsidized partly by the ministries interested and partly by the Luxembourg provincial government (**15**; 5.9.60).

Canada. Hurricane Donna finished its devastating journey of 3600 miles as a drenching rainstorm in Eastern Canada, which extinguished forest fires raging in the Maritimes after the long summer drought (**4**; 14.9.60).

Germany. Hevein, a new protein, has been isolated from fresh *Hevea brasiliensis* latex. It has a molecular weight of ca. 10,000, contains 5% S and 15% amino-acids, including cystine but not cysteine or methionine (**2**; July 1960).

Great Britain. A new X-ray technique for analysing and testing timber preservatives and flame retardants has been installed by Hickson's Timber Impregnation Co. (G.B.) Ltd. The Philips All-Vacuum X-ray Fluorescence Spectographic Apparatus is the first of its type in Great Britain, and completes in 10 min. what formerly took 1½ days. A testing operation consists of placing a sample in the X-ray beam at one end and reading off the figures produced on the recording unit. The sample is bombarded with, and energized by, an intensive beam of X-rays and, as a result, gives off secondary X-rays of different wavelengths. The spectrometer separates these rays by reflecting them from a crystal and measures the intensity of each by means of a scintillation counter. The final figures are passed by electrical impulses to the recording unit (**5**; June 1960).

Kent Naturalist Trust is trying to secure the preservation of a small part of the former Cobham estate which was bought from the late Earl of Darnley by Rochester Corporation some years ago. The Trust says these woods of Beech and Yew on chalk are an example of the original type of forest which once covered the Weald of Kent. They have been rich in many birds, including the rare buzzard, which has already been driven from its nesting place by the felling which the Council has already done. The Council intends to fell the woods and replant them mainly with conifers, Beech and Oak on a commercial basis. The Trust has appealed for the retention of about three-quarters of an acre of the wood as a 'living museum' (**4**; 15.8.60).

India. Kashmir's Forest Department has started mechanized logging in the rich forest ranges of Karen. Equipment has been set up at the Fakrian Pass at an altitude of 9600 ft., where skyline cranes lift 22,000 tons of timber daily over 4000 ft. (**12a**; 17.9.60).

Kenya. An attempt is being made to reproduce an Australian dry forest. This consists of *Eucalyptus crebra*, *Casuarina luehmannii* and two *Callitris* spp. In Australia the type occurs in the N.W. of New South Wales and the S.W. of Queensland, with a rainfall of 5–15 in. It is thought that it might well succeed in some of the lower-altitude, dry, eroded and termite-infested areas of East Africa (**18**; 1959).

Korea. A plant is to be established to make a building material called Tec-Pan out of the locally abundant rice straw. The product, developed and tested in the U.S.A., can be produced in panels of varying size and thickness, can be worked like wood, is light, but structurally strong, is resistant to vermin and moisture, and has insulating and sound-proofing qualities (**13**; March 1960) .

Latvia. Promising research into slash utilization includes the development of a modified hay-baler to make blocks 50 × 44 × 35 cm. from Spruce and Pine branches $\leqslant$ 6 cm. in diam., cut into 40- to 50-cm. lengths, for ease of transport to industrial users. Similar blocks made from Spruce branches, with the addition of sawdust or similar material for heat insulation and a wood preservative, have been used to build the walls of an experimental rural dwelling. The ordinary mortar used penetrates between the branches (placed upright), and imparts sufficient strength to the walls (**12**; 9.7.60).

Liberia. When the first 6 Liberian graduates from the Forestry School of the University of Monrovia received their degrees a few months ago, they became the first of a new generation of Liberian foresters, university-trained men who are expected to become leaders in the country's forests and forest industries. The staff of the School, partly provided by FAO, includes Liberians, Americans, British, Dutch and German instructors. There are now 45 students taking the 4-year course for B.Sc. in Forestry. The International Co-operation Administration of the U.S.A. has undertaken to provide a new school building, including a laboratory, research and other equipment, and a sawmill pilot plant. Liberia has about 4,000,000 acres of virgin forest. Most of this will be managed as national forest by the Bureau of Forest Conservation, established ca. 5 years ago. An inventory of these forests is about to be undertaken under an agreement between Liberia and the Federal Republic of Germany. The survey will take about 3 years (**7**; June, 1960).

Nigeria. A pressure-impregnation plant for timber is being installed by African Timber and Plywood (Nigeria) Limited at their Sapele mill. It will have a capacity of 250,000 cu. ft. per annum and will be the first commercially operated plant in Nigeria (**7**; July/Sept. 1960).

Sweden. After an initial trial period last year, using voluntary civil aircraft for patrolling Swedish forests against fire hazards, a special corps of flying clubs has now been organized for the purpose. It is expected that for the 1961–62 season it will comprise 175 aircraft in groups of at least 6 planes each. In principle, each provincial government will have at least one group at its disposal (**20**; 25.5.60).

Wooden objects recovered from the 'Vasa', the 17th-century Swedish man-o'-war now being salvaged in the Port of Stockholm, are being preserved by a special method involving immersion in a 30% solution of glycol in water, together with an anti-rot chemical, sodium pentachlorophenol. After 30 days in this solution, the objects are immersed in 100% polyethylene glycol and then allowed to dry slowly. The next problem is how to preserve the ship itself (**21**; Sept. 1960).

Thailand. The government-owned Forest Industrial Organization is to take over the cutting of all Teak and Yang in Thai forests. All cutting licenses, including those of native firms, lapsed on 31st May and will not be renewed (**12**; 2.7.60).

U.S.A. President Eisenhower on June 17, 1960, signed into law P.L. 86–517 directing that the national forests be administered for multiple use and sustained yield, which are defined in the law. It is considered to be a fundamental charter for national forest management and development, along with the 1897 Forest Administration Act (**14**; August 1960).

A map of the United States and southern Canada, showing average minimum winter temperatures in 10 zones across the continent, has been published by the U.S. Department of Agriculture, together with a table of representative plants, listed under the coldest zones in which they will normally succeed. The map represents a joint contribution of the National Arboretum of U.S.D.A.'s Agricultural Research Service and the American Horticultural Society (**22**; July/August 1960).

The National Academy of Sciences National Research Council has announced the formation of a new committee to investigate the relationship between chemical control of agricultural and forest pests and conservation of America's wildlife populations (**14**; August 1960).

An installation that converts ordinary waste sawdust into a nutritious organic fertilizer is now in full operation at Santa Rosa, Calif. According to its owner, Fersolin Corp. of San Francisco, it is the only installation in the U.S.A. capable of converting sawdust into a complete, balanced plant food and soil conditioner. The product, named Loamite, is said to be particularly useful where physical soil problems exist (**13**; May 1960).

A Californian rocket company is reported to build a small rocket for use in forest fire fighting. The rocket, which is powered by solid fuel, carries ca. 7 gallons of borate sludge (**1**; 25.6.60).

M.I.T.'s Ice Research Laboratory findings reveal exciting possibilities for the use of improved construction materials made from snow and ice. Addition of 15% sawdust will triple the tensile strength of ice, and as little as 4% fibreglass gives a tenfold boost in tensile strength. At present, because of low strengths of natural ice and snow, massive structures are required, but new processing methods should lead to superior ice materials to make practical the building of large structures in arctic regions (**13**; June 1960).

U.S.S.R. A new botanical garden was founded in 1950 in Tashkent (Uzbekistan). Of the total projected area of 80 ha., 40 ha. are now occupied by a 'dendropark' containing 1300 species of trees and shrubs belonging to the local, European, Far Eastern, Chinese, and North American flora (**16**; 10.9.60).

A tall fire-observation mast has been fitted with a long rope running over two pulleys fixed below the platform, which carries a seat on one end and on the other a container with sand acting as a counterweight easily adjustable to a man's weight. With the help of this device and a rope ladder, the fire-watcher can pull himself up in less than two minutes and come down in less than one. He can therefore do some useful work on the ground and visit his post at suitable short intervals (**9**; June 1960).

Zanzibar. *Eucalyptus 'zanzibarensis'* was formerly considered to be a Zanzibar strain of *E. rostrata;* it has, however, been recently determined as *E. tereticornis*. This strain is a distinctive one and has shown considerable promise (**7**; June 1960).

THE SOUTH AFRICAN FORESTRY ASSOCIATION

P.O. Box 1022 **Pretoria**

OBJECTS: To create a forum for the open discussion of all topics relevant to the science and practice of Forestry and allied subjects; to collect and disseminate information and statistics regarding silviculture, forest management, wood utilization and marketing, tree planting, forest conservation (including fauna, flora, land and water), and the recreational uses of forest resources in South Africa.

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For further particulars apply to:

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1. To foster public interest in forestry.
2. To secure general recognition of the dependence of timber supply upon forest management.
3. To collect and circulate information relating to forestry and the commercial utilization of forest products.
4. To form a centre for all engaged in forestry.
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